

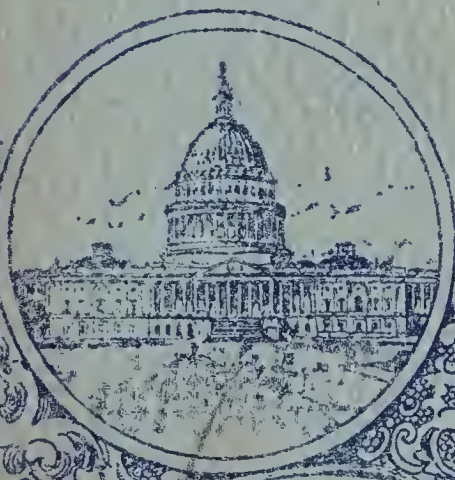
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Warmth for Winter Homes



U.S. HEATER CO.
DETROIT, MICH.

H. McCAMPBELL.



JEFFERSON AVE.
RESIDENCES
DETROIT

DR. CHAS. DOUGLASS



DR. S. G. MINER



JAS. H. Mc MILLAN.



WARMTH FOR WINTER HOMES,

WITH ILLUSTRATIONS
OF SOME BUILDINGS WARMED BY THE

CAPITOL HOT WATER HEATER.

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✓
UNITED STATES HEATER COMPANY.

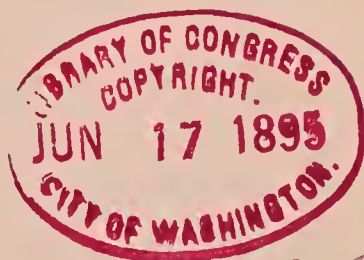
FACTORY AND HOME OFFICE, DETROIT, MICH.

CHICAGO—39 Dearborn Street.

NEW YORK—110 Beekman Street.

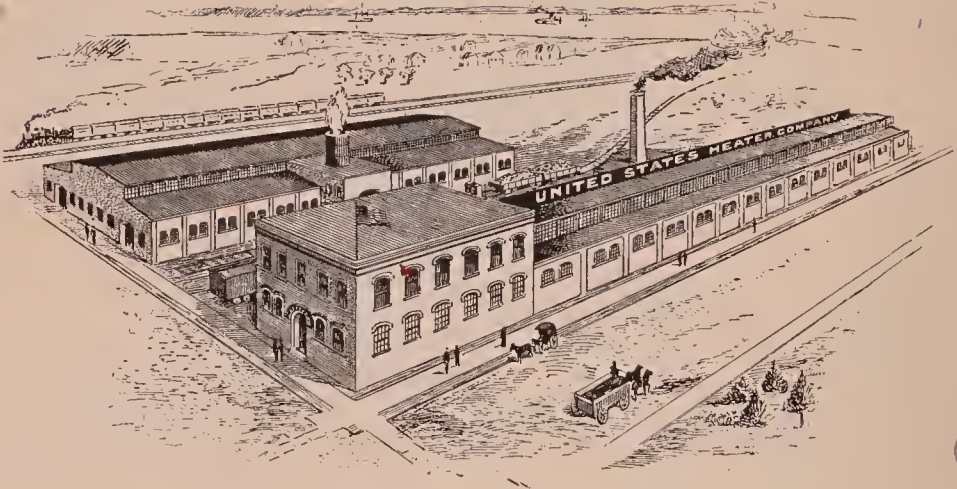
BOSTON—106 High Street.

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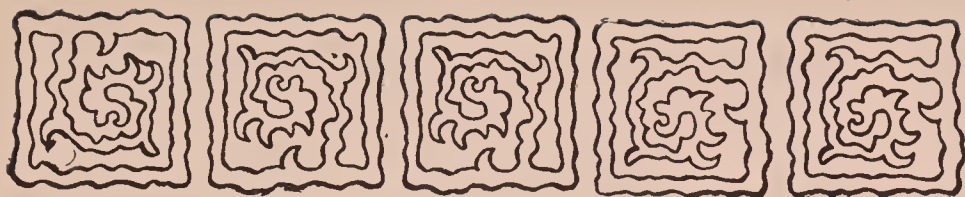


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UNITED STATES HEATER CO.
DETROIT.

WM. GRAHAM PRINTING CO
DETROIT.



Hot Water Heating.

*"Now is the winter of our discontent
made glorious summer."*



AFTER the roof and four walls which form a dwelling, and the three meals a day which should make glad the hearts of those within it, the next point of importance is the provision for warming the building during the six or seven months of the year in which artificial heat is needed in our climate.

Until lately the heating apparatus was the last thing considered in planning a house. Any place would do for the heater to stand, and almost noplac at all for the radiators or registers. Now all this is changed, and from the inception of the building the best disposition of the several parts of the heating plant is a subject of solicitude to the intelligent owner and architect. The chimney flue must be of the proper size, height and location; walls and basement must afford space for pipes, air-ducts and indirect radiators, and in the rooms place must be made for registers and radiators of such size and so situated that they shall do their work with the best effect.

THERE are three principal methods of warming an entire building with a single apparatus: hot water, steam and the hot air furnace.

The furnace being the cheapest retains its vogue where first cost is the chief consideration, but it has many grave faults. In severe weather, when heat is most wanted, the furnace can hardly be made to satisfactorily warm a house. This is notably the case in times of high winds, when rooms on the exposed sides of a building are apt to be uncomfortable.

Furnace heat is hard to regulate and is likely to alternate cold with excessively hot



Residence of J. F. FRANZEN,
St. Paul, Minn.



Residence of COL. J. B. HILL, Raleigh, N. C.

blasts, productive of discomfort, colds and headaches.

Dust often comes from the registers, and unless the furnace is new and especially well constructed, the gases from burning coal will sometimes escape into the rooms. The furnace requires much care and is wasteful of fuel. Consequently it is no longer used in the better class of buildings. Nobody nowadays builds a fine house at a cost of several thousand dollars and then, to save a few hundred, forfeits the comfort, convenience, healthfulness and ultimate economy of modern heating appliances.

HOUSES are warmed with steam by a heater in the cellar or basement, connected by pipes with radiators placed directly in the rooms, or else below them, with air ducts leading to registers in floor or wall.

As the steam in the radiators gives off its heat

it condenses, and in the form of water returns to the boiler, its place being supplied by more steam, forced into the radiators by the pressure at the boiler. The water of condensation on reaching the boiler is again converted in-



The Wheel Club Block,
Bellows Falls, Vt.

to steam. The boiling point of water is 212° , but in order to keep up the pressure necessary to maintain steam throughout the system, a temperature somewhat above this is demanded.

THE Hot Water system of heater, pipes and radiators is essentially similar to that for steam, but instead of only the heater containing water the entire system is filled to a point in the expansion tank higher than the top of the highest radiator. The circulation of the water from heater to radiators and back again is caused by the difference in weight between hot and cold water. When water is heated its particles expand. As they in-



Residence of DR. A. V. PARSONS,
Takoma Park, D. C.

crease in size without gaining weight they become relatively lighter than the more solid particles of cold water. When a portion of the water in the heating system is warmed a fraction of a degree it is at once crowded out of its place by the heavier particles of cold water,



Residence of N. TREIS,
Milwaukee, Wis.

which settle down and push the warm water to the highest point of the system. When a fire is lighted in the heater this action becomes continuous, and the hot water flows steadily upward from the heater to the radiators, where it gives off some of its heat and descends through the return

pipes to the bottom of the heater, which it again enters, forcing up the lighter particles of hot water. This action continues long after the fire is out—until the water in the radiators is as cool as the air surrounding them. The hot water in the flow pipes is constantly overbalanced and driven upward by the descending columns of cooler and heavier water in the return pipes.

The same water being used over and over again, only small replenishment is necessary to replace the slight loss by evaporation at the expansion tank.

BOTH the hot water and steam systems are clean and free from dust and odor; either will surely convey adequate heat to all parts of the building, unaffected by winds; both are in coldest weather economical, utilizing all the heat the fuel will produce.



Residence of DR. J. A. WRIGHT,
Toledo, Ohio.

ALL the advantages of water over steam are primarily due to the lower temperatures and the greater range of temperature at which the former can be worked.

There are not more than ten or twelve days in a year when

the full capacity of a heating apparatus is used. Steam radiators equal to such requirements are plainly excessive at all other times. But some



Residence of GEO. D. DIX, West Newton, Mass.

heat is needed and steam must be kept up. You must have steam and steam heat or no steam and no heat.

In the hot water system the faintest warmth starts circulation and the first heat given out by the fire is eagerly seized by the absorbent water and transmitted through the radiators to the rooms. So, in the chilly mornings or evenings of Spring or Fall a small wood fire that will raise the water to 80° or 100° will make the house comfortable for many hours.

Any desired degree of heat between this and the boiling point can be easily and accurately maintained by simply regulating the fire so as to burn only the quantity of fuel necessary to pro-



Residence of REV. C. S. STARKWEATHER,
Superior, Wis.

duce the required heat. This is easily done in the water apparatus without constant care. The water is a storehouse of reserved heat, and if you burn the

proper quantity of fuel to warm your house for

a day the water averages it up and distributes it with marvelous evenness throughout the day. The resultant *comfort* of this system is self-evident.

The same conditions imply the highest *economy*. The absorption of heat by the water is in



THE HANLEY APARTMENT BUILDING,
Detroit, Mich.

direct proportion to the difference between its temperature and that of the fire. The water apparatus is seldom run at as high temperature as steam, and most of the time at very much lower, so it is clear that as nearly as possible all the heat will be taken up by properly disposed surfaces, much of which if the surfaces were hotter would escape by the chimney. Moreover, it is never necessary to produce any more heat than is wanted in the rooms. The practical economy of this system is obvious and complete. It always furnishes adequate and equable heat combined with agreeable atmosphere at about two-thirds the cost of overheating and discomfort.

The hot water heater requires *less care* than any other because fluctuations in the heat of the fire affect the radiators slowly. It only needs

attention twice a day in cold weather—possibly three times is better when the cold is severe—and on mild days once is usually enough. If the



Residence of I. L. STRAUS,
Richmond, Va.

fire in a steam boiler gets low the steam condenses and heat quickly fails.

The superior *healthfulness* of a hot-water heated atmosphere over one warmed by any other means is so well known

that argument is superfluous. It need only perhaps be explained that the cooler the heating surfaces by which air is warmed the more completely does it retain its natural purity, vitality and agreeable quality; and that the admirable uniformity of hot water heat prevents drafts and over-heating, and maintains in all parts of the room and building, at all times, the warmth of the most delightful June day.



Residence of J. B. SHERMAN,
V. P. Union Stock Yards and Transit Co.,
Chicago,
Mt. Clemens, Mich.

FOR GREENHOUSES

Hot water heat is especially desirable, its steady maintenance of the proper warmth inducing the

best growth of the plants. The quality of hot water-heated air, being most closely like that of natural, mild summer weather, is a further incentive to thrifty growth. With other systems



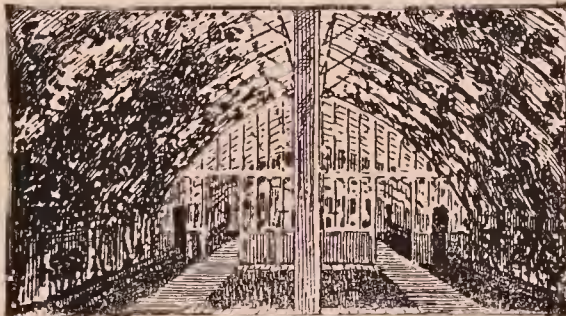
Greenhouse of J. BLANCK, Chicago, Ill.

there is, in spite of the best care, considerable fluctuation in the temperature, instead of the perfect uniformity of hot water. Moreover, this is the only method that can be relied upon to hold throughout the coldest night, with no attention, the temperature required for the best development of the plants.

A heater for a greenhouse should surely be of cast iron, as a moist atmosphere is quickly destructive of wrought iron.

Many heaters cannot be conveniently connected with the large mains which are frequently desirable in greenhouse work. This should be provided for in the heater without necessity of any extra fittings. The Capitol can be tapped for 4-inch mains.

We make special plans for the piping of greenhouses, which we will send free with any heater if desired.



IN SCHOOLS AND HOSPITALS,

More perhaps than in the home, a pure, healthful atmosphere is important, while freedom from drafts and overheating is manifestly essential to the best interests of the inmates.

Nothing can approach the perfection of a good hot water heating apparatus, in conjunction with a good system of ventilation. In buildings of this class ex-

pense should not be considered in comparison with the health and comfort of teachers and scholars.



Children's Hospital, Columbus, O.



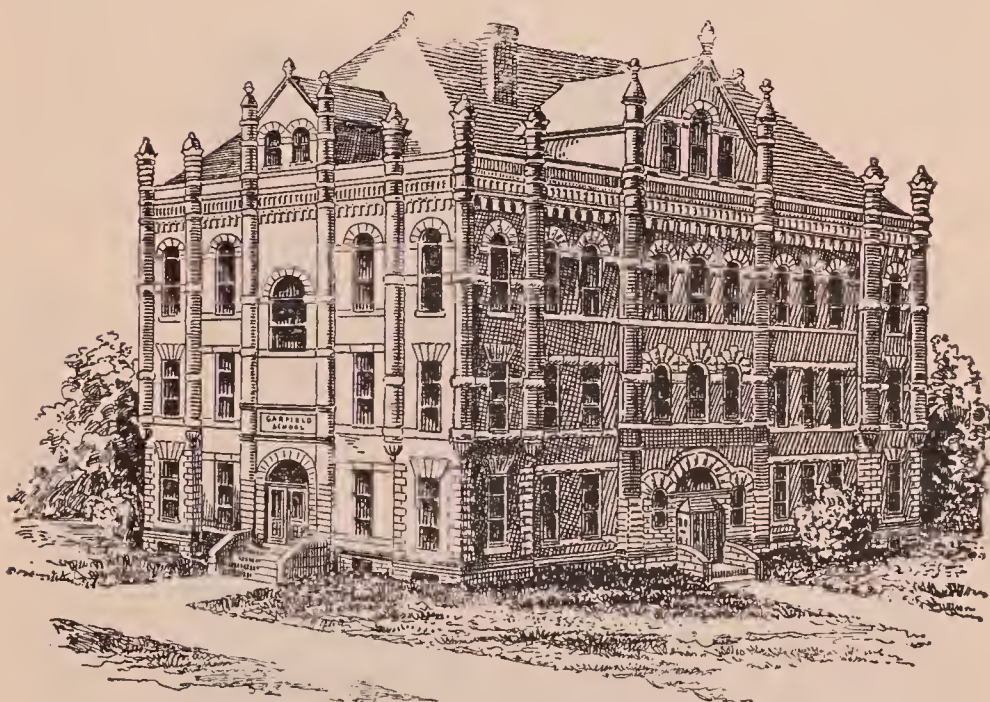
Lincoln Hall, Chapel, Soldiers and Sailors Orphan's Home
Knightstown, Ind.

BATHS, Etc.

The smaller sizes of the Capitol Heater are very effective for warming large swimming or other baths. In no other way can water be so economically heated.



CLEVELAND ORPHAN ASYLUM.
Versailles, Ky.



GARFIELD SCHOOL,
Pottsville, Pa.

SOME TYPICAL DIRECT RADIATORS.



THE NIAGARA RADIATOR



THE STANDARD RADIATOR.

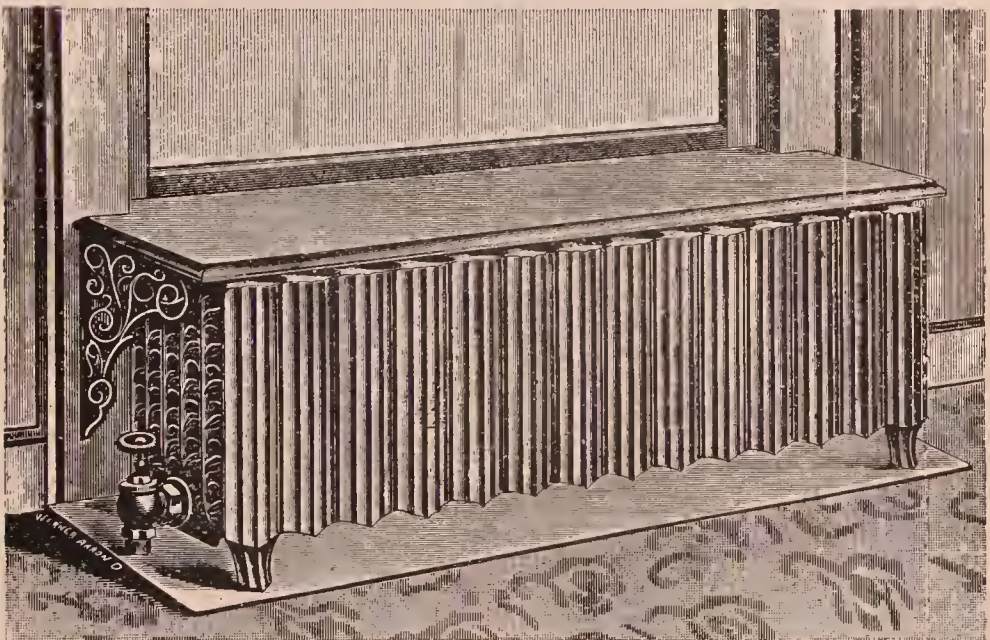
Radiators, etc.

There are three classes of radiators used in connection with steam or hot water heaters. That which is most commonly used is *direct* radiation — so called because placed directly



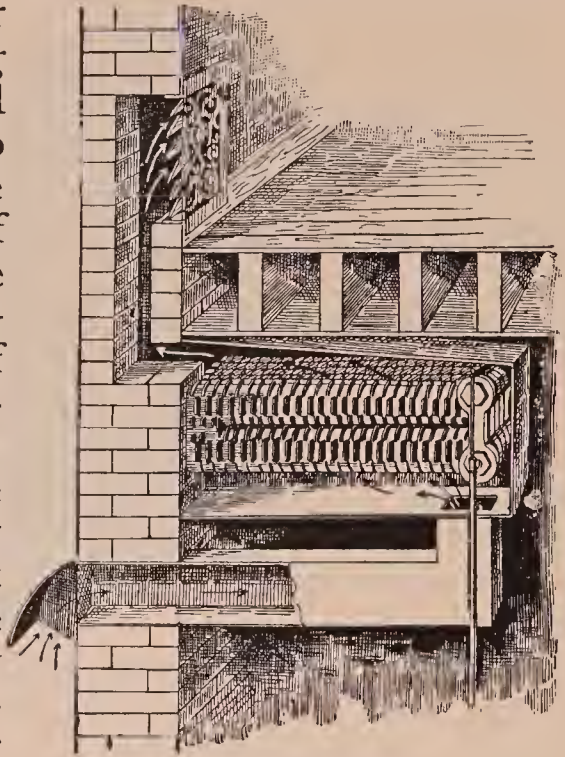
Residence of DR. A. O. BLISS,
Hyattsville, Md.

in the rooms to be heated. This system is the cheapest in first cost as well as in consumption of fuel. Its exclusive use in a building is open to the objection that it makes no provision for introducing fresh air. Besides, in some rooms space cannot conveniently be given to radiators large enough to furnish adequate heat.

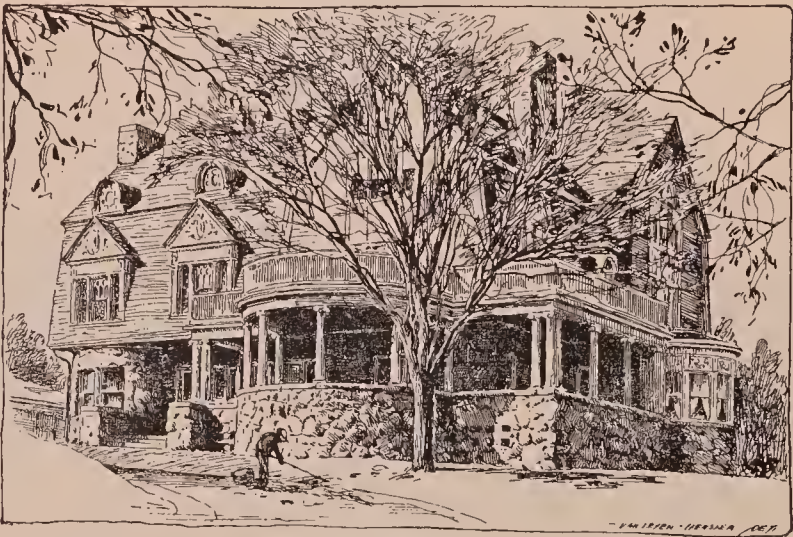


A LOW WINDOW RADIATOR.

Indirect radiators are placed in the basement and a current of fresh air from out of doors is passed over their surfaces, being thus heated and then transmitted to registers in the walls or floors of the rooms to be warmed. This insures a supply of fresh air, but in severe weather is likely to leave the room insufficiently heated. It is not therefore desirable to depend entirely upon indirect radiation for warming a room, but some direct should also be used. Besides, indirect costs more to put in and requires more fuel and larger boiler capacity to do the same work.



INDIRECT RADIATOR.



Residence of F. H. DAVIS, OMAHA, Neb.

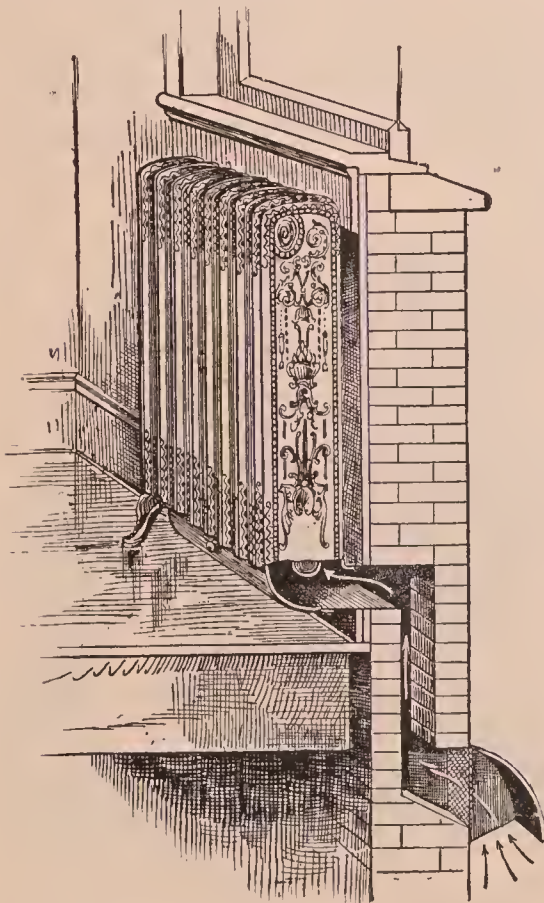
Direct-indirect is the name given to a direct radiator standing on an enclosed base, into

which fresh air is introduced and thus heated before passing into the room. These radiators occupy a little more room than direct, do not look quite so well, and use a little more fuel. Their merit is in the ability to shut off either the heat or the air, or both, a little or entirely, as may be desired.

Probably the most common practice, where expense is not a controlling element, is to put indirect radiation in the hall and the principal rooms on the first floor, such as parlors, dining-room, sitting-



Residence of F. A. CROSBY
Beverly, Mass.



DIRECT-INDIRECT RADIATOR.

room, etc., which are sometimes occupied by a considerable number of people. In these rooms some direct radiation is also placed, frequently in the form of coils or low radiators under hall or window seats. The other rooms are then furnished with direct radiators. Where this is considered too expensive a large indirect radiator in the lower hall is relied upon for fresh air supply, direct radiators being used elsewhere.

VENTILATION.

If warmth is necessary to life, pure air is essential to health and comfort. The increasing density

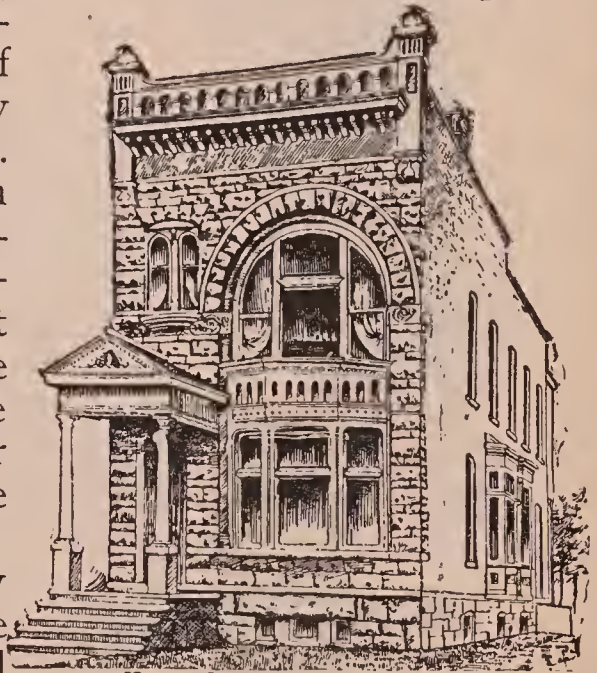


Residence of CHAS. F. LUCHERMAN.
St. Louis, Mo.

of population makes it more difficult to get a supply of air which shall have never before been in the lungs of others—or of ourselves. The “improvements” in building, too, render some ventilating system necessary, because the

perfectly built house of the prosperous citizen is without the leakages which, however disagreeable, doubtless promote the health of the dweller in many a poor tenement. Fortunately such attention is now being given this subject as to make it common for some provision to be made for the proper ventilation of the best buildings.

Heat is usually the most effective, and economical, and often the only available agent for changing the air in buildings



Office of DR. J. A. WATLING,
Ypsilanti, Mich.

and keeping it always fit for breathing. Therefore no heating system is now considered com-



Residence of W. W. CLIVER,
Terre Haute, Ind.

plete which does not comprise a scheme of ventilation. The provision is sometimes faulty and inadequate, but is almost always better than nothing.

Quite commonly the thing is only half done. In some cases excellent arrangements are made for the removal of foul air, depending for a fresh supply upon

what can find ingress through the crevices around doors and windows of even the best built houses. The air thus brought in is cold and makes undesirable drafts. Sometimes properly warmed air is introduced through registers, depending upon open windows, etc., to carry off the foul air.



Residence of GEO. L. WALTERS,
Sharpsburg, Pa.

Every house should have one or more indirect radiators, furnishing the proper quantity of warmed fresh air, and in each room a ventilating duct leading to a flue in which an upward



Residence of Dr. R. V. PIERCE,
Buffalo, N. Y.

current of air is maintained by heat. The fact is often overlooked that foul air is heavier than pure air, and settles to the floor. Hence, the foul air outlets should be as close to the floor as possible, for here is the foul-

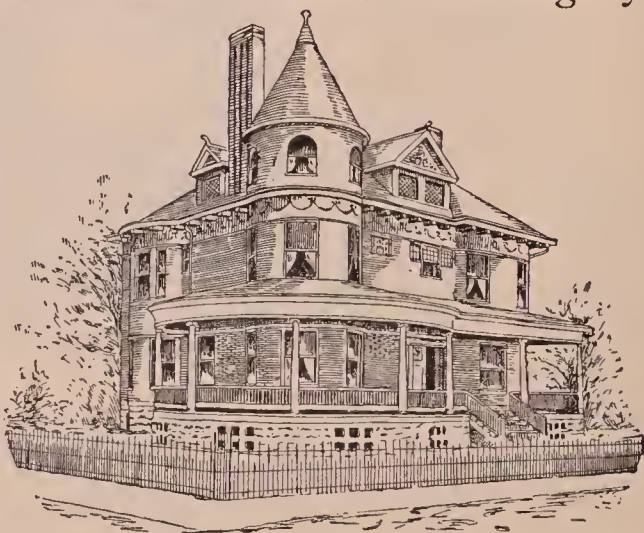
est as well as the coldest air in the room. Open fireplaces are not bad ventilators, but take the air from a point rather higher than is desirable. When not in use it is well to close them, save a narrow opening at the bottom.

A ventilating flue without heat is useless, as more likely than not the current will be downward into the heated room, instead of upward and outward.

For schools, hospitals and other public buildings a rather more elaborate system is necessary, as all the air in the rooms should be thoroughly and frequently changed.

When the Capitol heating system is to be used we furnish plans for ventilating, in accordance with the most approved modern methods.

In planning a new building or



Residence of CHAS. K. PORTER,
Michigan City, Ind.

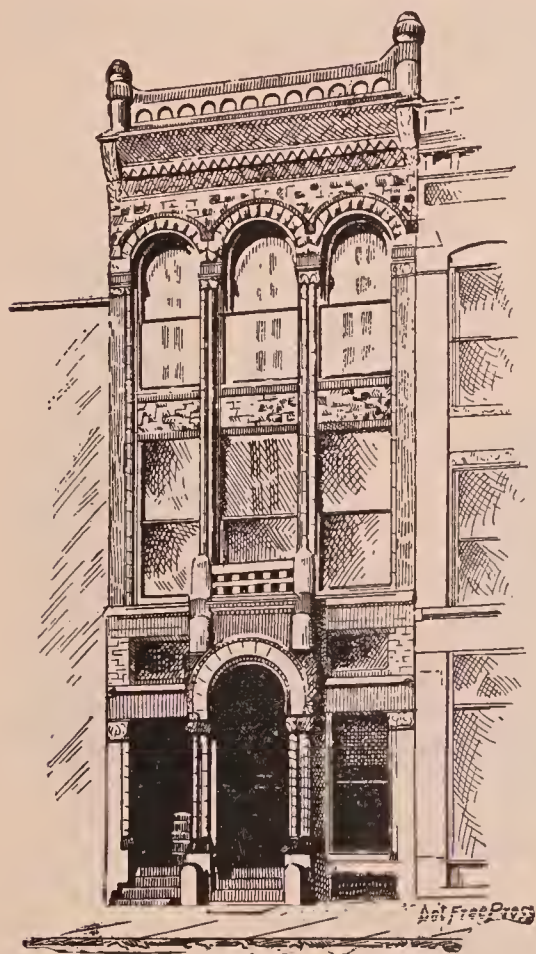
remodeling an old one attention should surely be given to this point. It makes a little extra expense and will necessitate the use of a little more fuel, all of which will be more than repaid by diminished doctor's bills and increased comfort.

SUGGESTIONS.

It is important to get a heating apparatus above, rather than below the actual requirements of the building. This gives some reserve capacity to fall back on in times of exceptionally cold weather, and ensures ample heat at all times. Besides, the more radiating surface there is in a room the lower will be the temperatures that will furnish adequate heat, and consequently the more healthful and genial will be the air in the

room. Moreover, fuel is thereby saved, as the cooler the water the more heat it will absorb, and the less will escape at the chimney. It is therefore a good investment to get a little more capacity than necessary. It saves fuel, saves care and gives better results.

No heater, however excellent, will do its work unless it is properly set and connected with a well-devised and correctly put up system of piping and radiation. Hot water heating has



Second National Bank,
Lexington, Ky.

not been in use so long or so generally as steam, hence it is usually harder to find expert hot water fitters than those capable of doing a first-class steam job. Great care should be taken to see that the plans for the work are laid out by heating engineers of the highest skill and experience, who will guarantee the correctness of their plans, and that the work is put in by reliable and expert workmen. Attempts to get the job done too cheaply commonly result in a simple attainment of the one point, a cheap job—almost necessarily an unsatisfactory one. From a purely economical standpoint it is clear that when an expenditure is to be made amounting to several hundred dollars, it is a short-sighted policy to jeopardize the entire investment in order to save a small sum. The withheld dollars will surely have to be paid out over and over again in coal bills, to say nothing of repairs and alterations.



Residence of RICHARD P. MARVIN,
Akron, O.

Choice of Heater.

IN selecting a heater, the judgment of the non-expert is likely to be obscured by the fact that “doctors disagree”—at least in their mode of setting forth what constitute the essential points. If the buyer can know the features that should be embodied in a heater, and the reasons why they are desirable, he can more intelligently compare the merits of the different constructions.

The primary object is to heat a current of water whose movement is due solely to the application of heat. For this a grate is needed of a size that will burn, without forcing, enough fuel to produce the quantity of heat that will warm the building in the coldest weather. The water must then be made to pass over the fire in such a way as to absorb as nearly as possible all the heat, except what is necessary to make a draft in the chimney.

The rapidity with which water takes up heat from fire is in direct proportion to the difference in temperature between the water and the fire. In cold water circulation will start even from a small fire with wonderful quickness. As it gets hotter dampers must be closed and the products of combustion brought repeatedly in contact with the water surfaces, so that the less receptive water can extract from them their heat. As soon, therefore, as particles of water are heated a single degree, they should make way for cooler and more receptive particles. The faster the water can be made to pass over the fire surfaces, the more heat it will carry away in a given time.

The only direction in which heat will move—water is vertically—the hot water moving upward and the cold downward. Water in horizontal spaces will hardly move away from the fire at all, save as it is forced by the movement of neighboring currents in vertical spaces. The force of the vertical currents will manifestly be lessened by just so much as it is spent in maintaining the lateral currents. Water in stagnant masses is only heated throughout by means of little vertical currents which it sets up within itself. *Hence, Vertical Circulation throughout is the first point to be attained*, as in this way can the water be passed most rapidly over the heating surfaces.

If a current of hot air is passed upward through a vertical flue surrounded by water, the greater part of the heat will move directly upward in the centre, where there is least friction, never touching the water surface to impart to it any heat. The effect is the same when passing upward among several vertical tubes filled with water. But if such a current is made to impinge pretty squarely against water surfaces, every particle of the air is brought in contact with the surfaces, where it gives off more or less heat. *Hence, having vertical circulation, the surfaces can only be made fully effective by lateral draft.*

Every time the products of combustion strike cooler water surfaces more heat is imparted to the water, so they should be made to do this *as squarely and as often as possible without destroying the draft.*

Aside from its circulation water is pretty nearly a non-conductor of heat. A heated particle of water will hardly give off any of its heat to a neighboring particle, so that the heating of a mass of water depends upon each particle in turn being brought in contact with the heat. Water in large bodies therefore heats far more

slowly than when it is divided into small columns exposed to the fire on all sides, so that the greatest proportion of water is brought in contact with the heat and is itself heated. It is surface alone that utilizes the heat—good surface, well exposed to the direct action of the heat. Accordingly, the next desideratum is *the largest extent of efficient surface in proportion to the quantity of water contained in the heater.*

A round tube contains the largest possible quantity of water, in proportion to its external surface. If the tube is somewhat flattened its holding capacity will be reduced while its circumference and external surface are unchanged, The more it is flattened the less it will hold, and, conversely, the greater will be its surface in proportion to its capacity. A square pipe or section holds less than a round one having the same surface, but even this fails to give the full benefit of its surface. *The most effective and practical is a pipe of a pointed oval shape.*

Some heaters are shipped with their water joints made up. This is wrong, as they rarely withstand the rough handling of transportation without more or less loosening. This is particularly true of pipe heaters, which contain an extravagant number of water joints, many of them almost impossible to get at for repairs without the labor of removing and replacing a great many sound pipes. The largest sizes of these heaters are so heavy as to be exceedingly awkward to handle. They hold the same place in the estimation of freight handlers as does the "Saratoga" trunk with the "baggage-smasher," and receive about the same treatment. *Heaters should therefore be shipped in sections, and the joints should be such as can be easily and perfectly made up by a mechanic of average intelligence.*

Probably nothing in connection with an otherwise good heater causes so much annoyance and expense as the frequently imperfect joints.

Rubber, asbestos, or similar packing is used for the water joints of most heaters, and should be avoided. No such packing is made that will not, after the alternate use and disuse of several winters and summers, shrink or disintegrate, causing leaks. Most joints are subject to expansion and contraction which may cause leaks. Threaded pipe directly exposed to the heat and gases from burning coal gives out more quickly than any other part of the heater, the iron being already partly cut through and its hard surface removed by the thread. *The model joint should therefore be all metal, and it should be outside the heater, so as not to be affected by the action of the fire and to be accessible for any necessary tightening.*

There is no longer any sincere discussion as to the best material of which to make a hot water heater. The superiority of cast iron as a transmitter of heat seems to be established beyond question, and in a properly constructed heater or radiator there is no danger of cracking from unequal expansion and contraction. Formerly there was some difficulty in avoiding an excessive weight of metal, and a proper lightness was only to be had in wrought iron. This was the day of pipe heaters and pipe radiators. Modern skill produces castings lighter than the "Extra heavy" pipe used in some parts of the best pipe heaters, and little, if any, heavier than the light "Standard gas pipe" used to some extent in all and exclusively in some heaters.

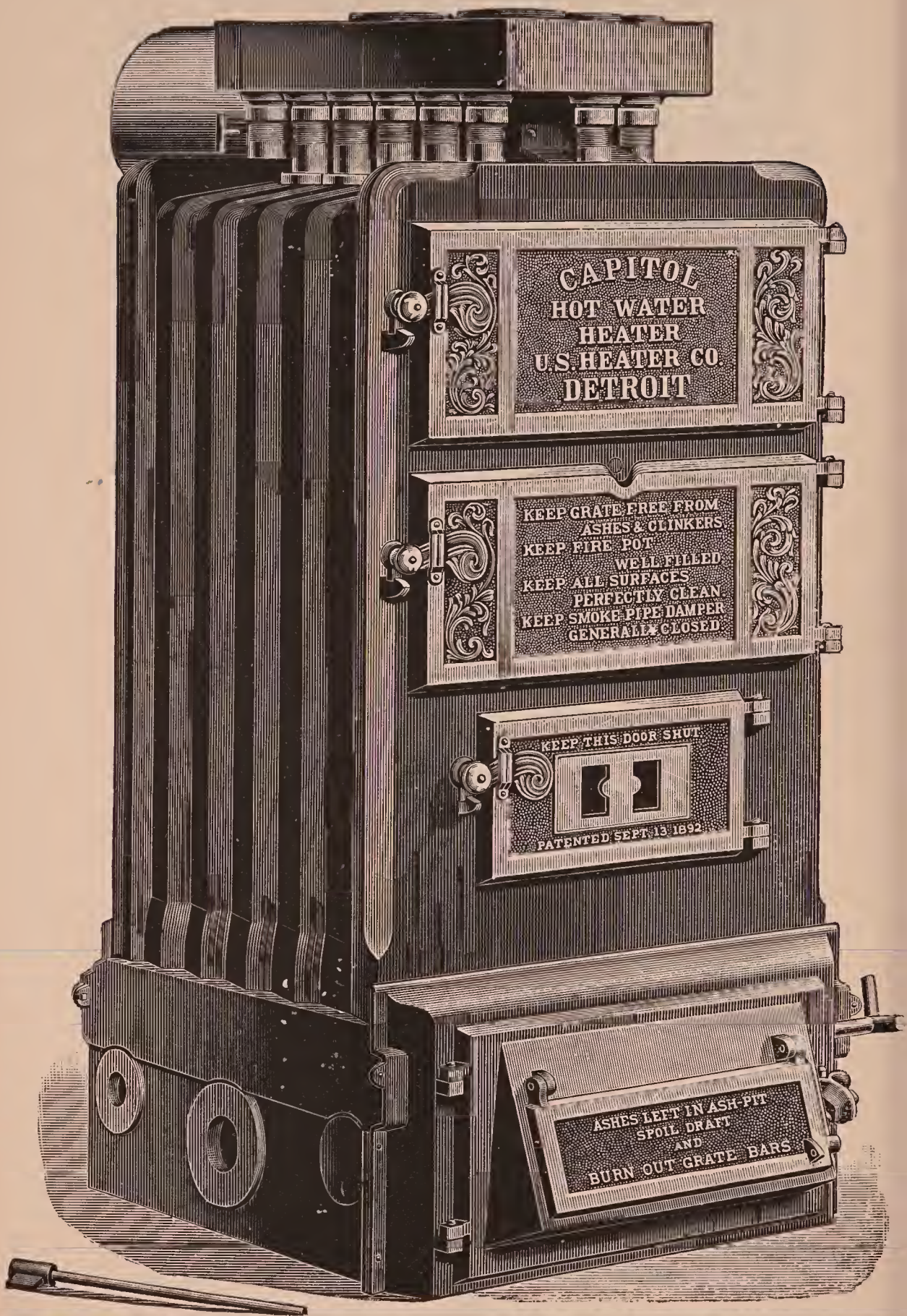
This brings up that most important point, the exceedingly bad record of pipe heaters in respect to durability. There are some cases where extraordinary combinations of favorable conditions have enabled pipe boilers (we refer only to those used for house-heating purposes, with coal or gas as a fuel), to give something like a respectable term of service—barely, however, furnishing enough exceptions to prove the rule,

recognized by experts and practical men, that for such purposes *Cast Iron will for years outlast Wrought Iron or Steel.*

Ease of cleaning is of great importance. Accumulations of soot and ashes not only obstruct the flue openings and destroy the draft, but form on the surfaces a non-conducting coating that neutralizes their efficiency in proportion to its thickness. Vertical surfaces are, naturally, least likely to catch such accumulations and most easily freed from them. But it is essential that every inch of surface should be readily accessible to brush and scraper, through convenient doors. *Get a heater, then, with the least possible flat surface to catch dirt, all fire surfaces easy to brush, and no little flue holes from which the soot can be but imperfectly removed.*

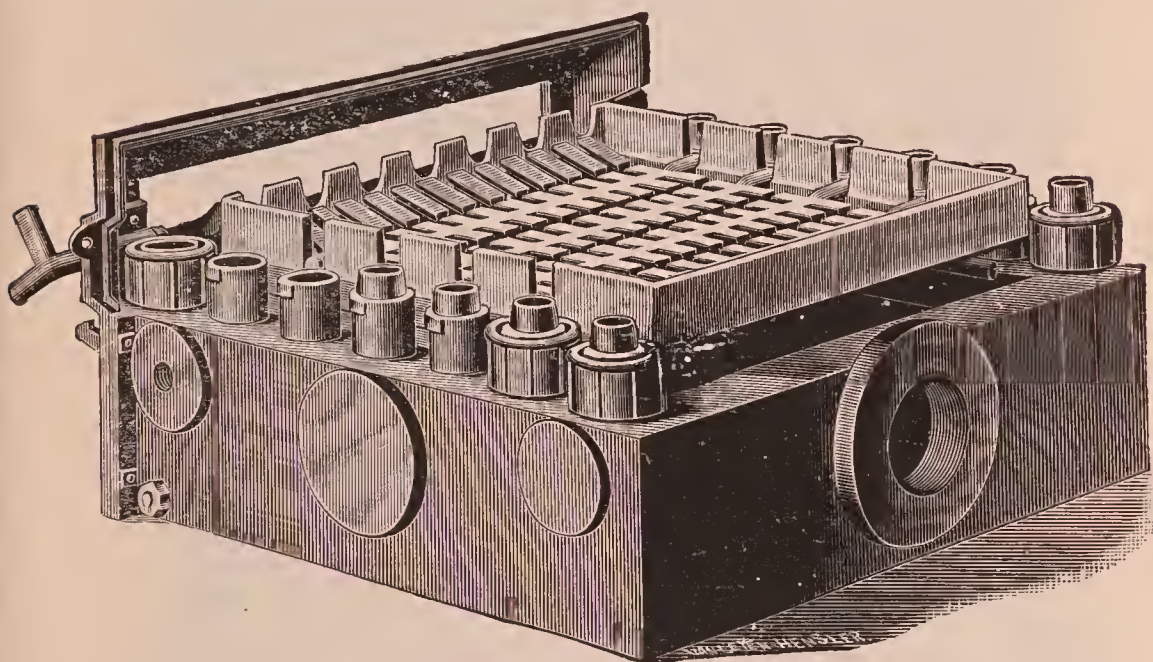
Many cast iron boilers are built of horizontal sections, and sizes are often increased by the simple addition of another section. This is clearly wrong. If before the extra section was added there was enough fire surface to take up all the heat from a fire of that size nothing can be gained by more surface. If the increased surface is necessary to extract all the heat, then in the smaller size some of the heat is wasted for want of enough surface to absorb it all. The construction that is recognized as *the best is the vertical section, where the grate surface is always in the same proportion to the fire surface.*

The heater will not last forever, nor, like the "one-hoss shay," will all parts prove equally durable. Some part must give out first. *Get a heater which will not be totally disabled by a single defective section, and one in which a broken part can be replaced quickly, cheaply and easily.*



The Capitol Heater.

THE construction of the Capitol Hot Water Heater is shown by the accompanying illustrations. The back and sides of the ash-pit base are hollow, forming a water space into which the return pipes are brought.

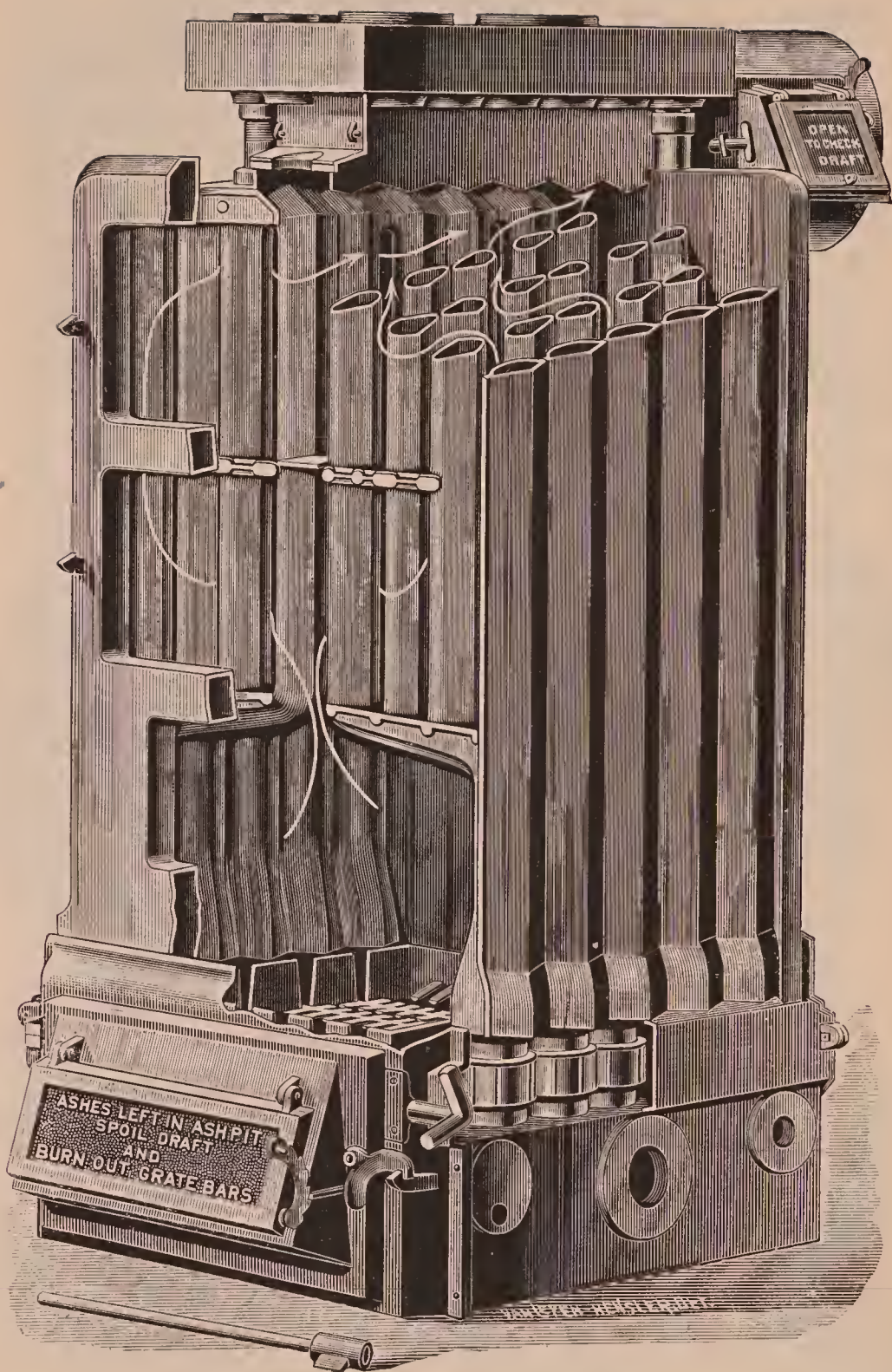


ASH-PIT BASE.

The back and front, and the intermediate sections that make up the body of the heater, rest upon and are connected with this base.

They are connected at the top with a header, from which the flow pipes are taken.

The bottom connection is a slip nipple, drawn tight by a coupling, on the inner side of which is a cam that engages with lugs on the castings. The top connection is a special long-screw nipple, with a soft metal gasket which fits into



a counter-sunk recess in the top casting. When the joint is made up this soft metal is forced into the thread by the wedge-shaped top of the lock-nut.

The intermediate sections thus placed, stand in two opposite rows. Between the rows is a smoke opening, extending from front to back.

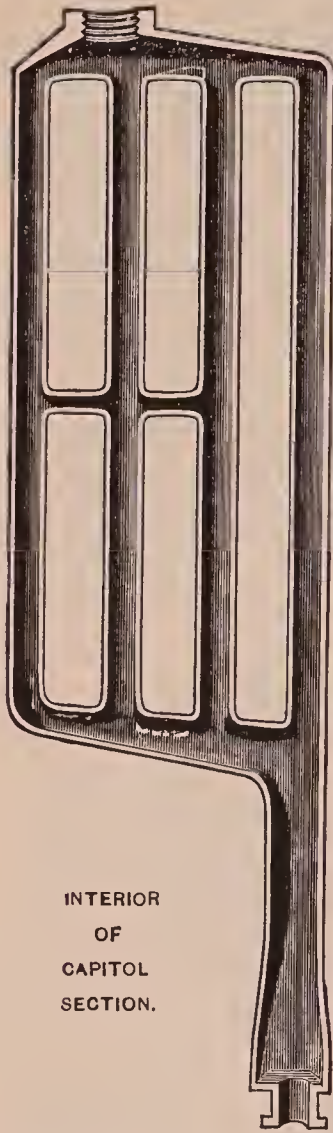
The rocking and dumping grate, resting on the cast-iron ashpit, has one grate-bar for each section of heater, so that the proportion of grate to fire surface is always maintained, whatever number or width of sections may be used.

The fire-pot is so arranged as to give a good combustion chamber, in order that all the gases given off by the burning coal may be properly consumed. In many heaters the gases are permitted to escape by numerous openings pretty directly upward into the flues, where they are quickly cooled by coming in contact with the water surfaces. Our fire-pot has a solid top, with the exception of the long, narrow smoke opening in the middle. In this way the gases are to an extent retained and exposed to the heat of the fire, so that they are as nearly as possible consumed instead of being condensed and wasted. This is highly important, as a very large proportion of the heat-producing element contained in the coal is first given off in the form of gas. This should be burned. If it is wasted only a comparatively small part of the benefit that ought to be had from the coal is secured.

The intermediate section is, of course, the most important part of the heater so far as regards its effective working. The Capitol section is so designed as to give the greatest possible heating surface in proportion to the quantity of water contained and the space occupied, and still afford ample flue opening for the escape of the products of combustion.

This section consists of vertical water pipes connected by three horizontal waterways, the

lowermost of which meet when the sections are set up, and form the roof of the fire pot, while the top waterways form the top of the heater proper. The middle waterway, as will be seen by the cut, does not extend clear to the outside of the heater, but leaves a space for the smoke



INTERIOR
OF
CAPITOL
SECTION.

to pass upward. A heavy baffle-plate cuts off the middle smoke opening so that the draft has to pass from the middle of the heater to the side and then back to the middle and out through the smoke pipe.

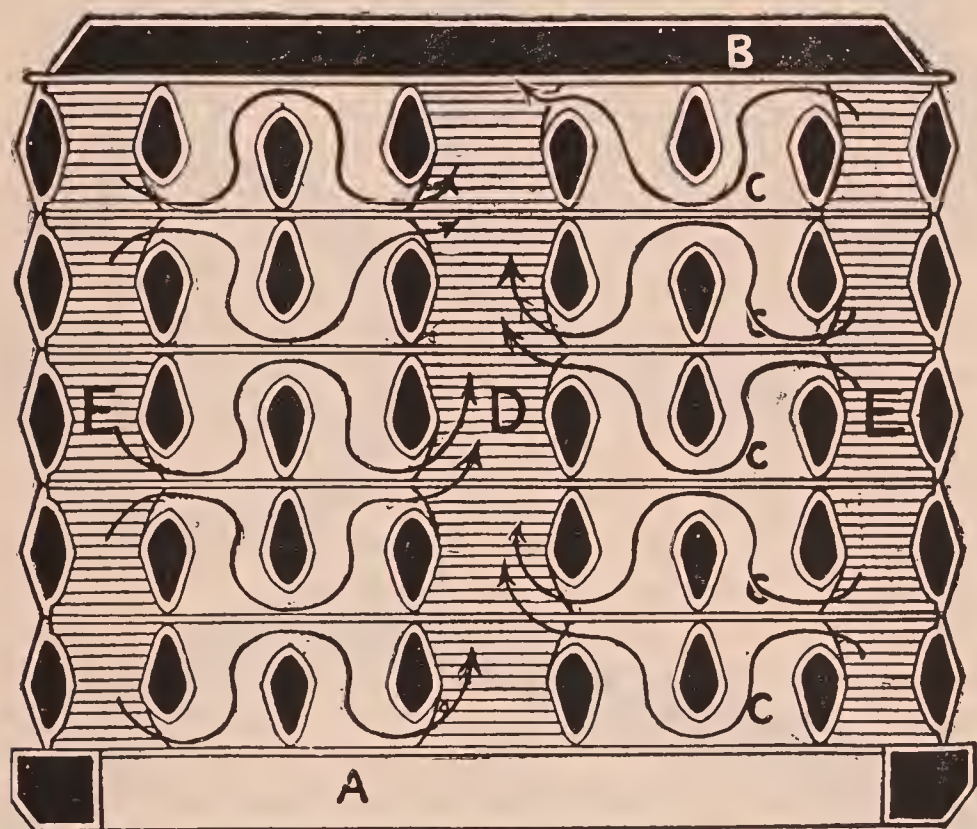
The pipes are not in straight rows, but are "staggered" as shown in the cut on opposite page, so that the gases, in passing from the middle to the sides and back again, not only cross at right-angles with the water surfaces, but are compelled to follow a zigzag route, being repeatedly deflected and made to change their course. This brings every particle of the heated gases into contact with the water surfaces, which are thus enabled to absorb the heat.

A rapid circulation of the water is attained by making its direction purely vertical. There are no flat surfaces anywhere to check its upward course.

During the operation of a heater small quantities of comparatively cool water are carried upward by the ascending current of hot water. This cool water has a constant tendency to get back again to the bottom of the heater, and makes counter-currents and eddies which are undesirable. The Capitol heater provides a re-

turn passage for such water. When there is cold water to be returned to the base, there is circulation within the heater, all the cool water passing downward through the outermost water tube of each section without interfering in any way with the ascending current in the interior tubes which are more directly exposed to the fire. Each section is, in itself, a complete circulator or heater.

The sections are not made to fit tightly, thus obviating the necessity of carefully fitted smoke-joints, which are perfectly made by the asbestos



CROSS-SECTIONAL VIEW.

A—Front. B—Back.

CC—Sections.

D—Middle Smoke-opening.

EE—Side Smoke-opening.

Darts show lateral direction of draft, above the middle water-way.

covering. This easy adjustment prevents any strain upon the castings and, in connection with their carefully calculated shape, avoids possibility of cracking from unequal expansion and contrac-

tion. While cracked sections are common in many hot water and steam heaters, as everyone knows, they are, in our experience, so rare as to be practically unknown.

If a Capitol section should get broken it can be cut off by plugging the openings in the base and top, and the heater used without it until a new part can be put in. Any section can be removed and replaced without disturbing the rest of the heater.

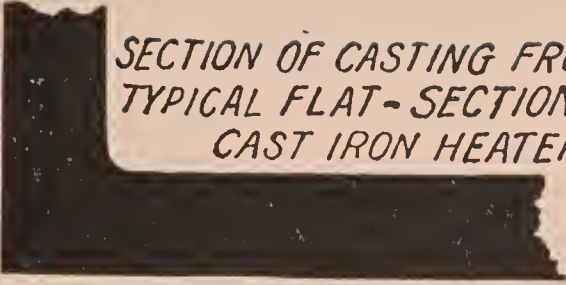
The parts are interchangeable, and as no special care is necessary to fit them to each other the heater is most easily set up.

There is not a bolted joint in the heater, nor any rubber, or other similar packing—nothing but metal. The joints are few in number, and all are practically outside the heater, away from the action of the fire. They are very easily made up and once tight will remain tight forever. If by chance they should not be tight when the heater is first set, they can be tightened without letting the fire out or even opening the door of the heater, as they are all on the outside, and accessible for any necessary tightening.

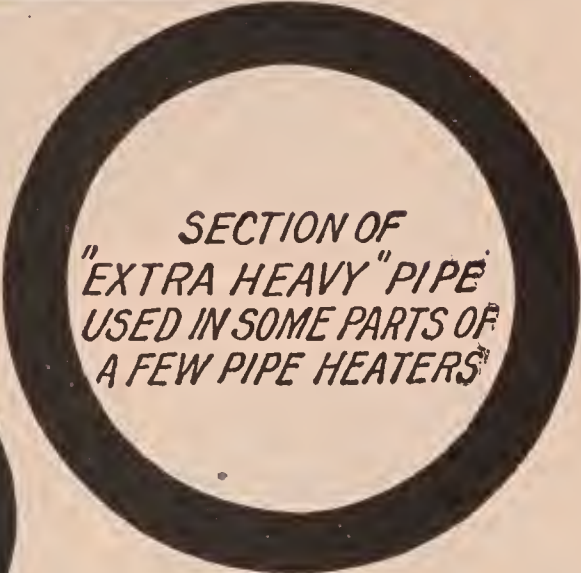
The heater is very readily cleaned, as every inch of its heating surface can be easily reached through the front clean-out doors by brush and scraper. The broad sides of the tubes are presented to the brush, which easily removes all soot. There are no inaccessible flue openings about it anywhere. This is very important, as a large percentage of the trouble with hot water heaters is due to their surfaces becoming coated or their flues obstructed.

The Capitol is designed to be used as a portable heater, coated with asbestos; but it may be encased in brick if desired. The brick casing may be so arranged as to make a return flue heater where the draft in the chimney is strong.

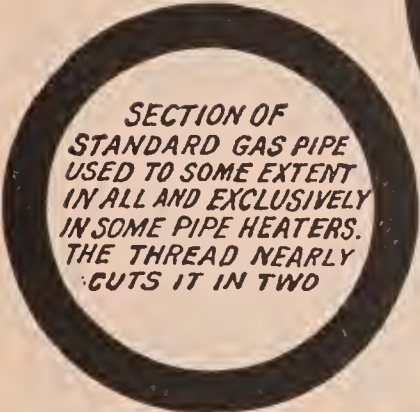
It is shipped in sections, which are easy to handle and can be carried through any opening



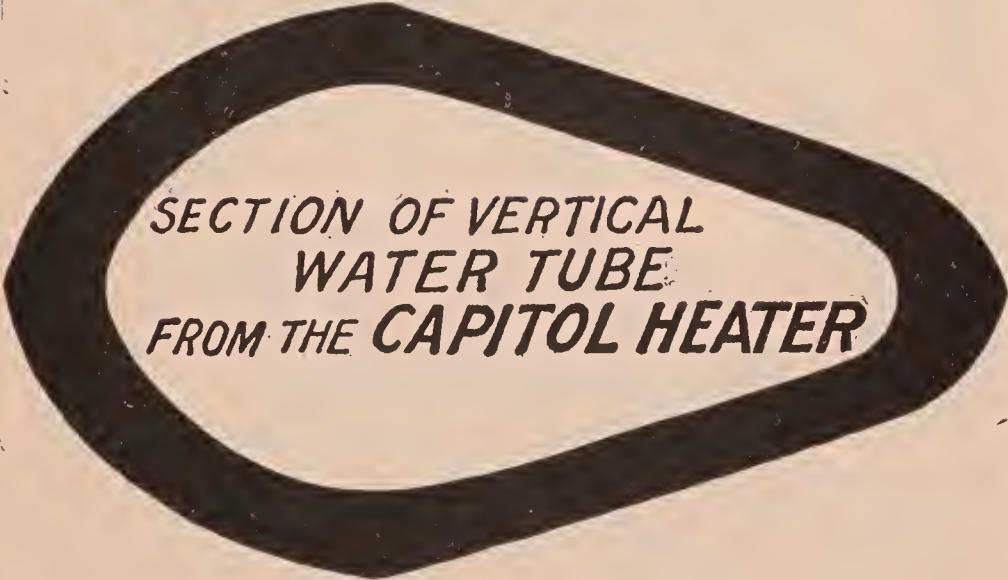
*SECTION OF CASTING FROM A
TYPICAL FLAT-SECTION
CAST IRON HEATER*



*SECTION OF
"EXTRA HEAVY" PIPE
USED IN SOME PARTS OF
A FEW PIPE HEATERS*



*SECTION OF
STANDARD GAS PIPE
USED TO SOME EXTENT
IN ALL AND EXCLUSIVELY
IN SOME PIPE HEATERS.
THE THREAD NEARLY
CUTS IT IN TWO*



*SECTION OF VERTICAL
WATER TUBE
FROM THE **CAPITOL HEATER***

which a man can enter. It can be quickly set up and the joints readily made by any competent mechanic.

The heater can be entirely drained of water, thus removing all sediment, and preventing freezing when not in use.

The return pipes are brought in below the grate, avoiding possibility of reversed circulation.

Doors are lined to prevent loss of heat.

Special pains are taken to produce perfect castings. We use the grades of iron that experience has shown to be the best, and employ expert labor, while our patterns and foundry equipment excel those of any other manufacturer of house-heating boilers.

We are thus enabled to produce castings of superior strength and toughness, and at the same time so light as to oppose the least possible resistance to the transmission of heat from the fire to the water.

This nullifies the only objections ever raised against cast iron boilers. The Capitol will not crack like the old constructions, nor is it so heavy as to interfere with effective action. Our castings are of about the same thickness as the extra heavy pipe of which the best wrought iron boilers are made, and will not, like them, rust away in a few years.

We test all our sections to 100 pounds, hydraulic pressure, and afterwards test them thoroughly with steam.

All the work about the heater is carefully done and rigidly inspected, so that there is hardly a possible chance of imperfect goods going out from our factory.

Thus made, the Capitol is a good heater—good all around, and excellent in every point. It has an unexcelled record for first-class service in the coldest parts of the United States, in temperatures ranging from 30 to 40° below zero.

CHICAGO
RESIDENCES

GEO. ROUNSAVELL.



JAS. ARTHUR.



COL. J. S. COOPER



JOHN W. LOW
EVANSTON.



Prof. Allen's Report

ON
THE CAPITOL
HOT WATER HEATER.

OFFICE OF LEICESTER ALLEN,
ENGINEER,
ROOM 49, ARBUCKLE BUILDING,
BROOKLYN, N. Y.

UNITED STATES HEATER Co :

GENTLEMEN—In compliance with your request for a written opinion upon the general design and construction (as indicating efficiency or otherwise) of the Capitol Hot Water Heater, I have carefully scrutinized it with reference to well known and accepted principles of scientific construction in heaters of this class.

Your statement of the principles upon which the heater is based, renders it evident that the designers are well informed in the requirements for a good hot water heater, and that if competent mechanically to apply these principles a first-class heater could hardly fail to be the result of their careful and deliberate effort. These principles, which both theory and practice confirm as essential to highest efficiency, are hereinafter noted ;

1. Circulation of water over the interior heating surface in a vertically upward direction ; or, if this be departed from anywhere, circulation in a direction so much inclined from the horizontal as to insure rapid flow of water (unmixed with any steam formed at points where flow is retarded, as in some hot water heaters) upward and over all parts of the surface, thus securing the maximum contact of the water with the

heating surface in the minimum of time. In other words, to secure the greatest velocity of flow upward through the heater, of water, *as water*; not water partly mixed with steam, which latter is subsequently condensed to water again when mingled with other water in some part of the system more or less remote from the heating surface.

For securing the thorough application of this principle the Capitol Heater appears to be all that can be desired. I estimate that fully 85 per cent. of its effective heating surface is vertical; and as this gives the direction to the flow, the principle cannot fail to be carried out much more perfectly than in many heaters in the market, and to an extent not exceeded, I think, in any now known to me.

2. The principle, also vital to *efficiency*, either in hot water heaters or steam boilers, that the products of combustion, *i. e.*, the flame and hot gases, shall strike the heating surfaces as nearly as practicable at right angles, is very thoroughly secured in the Capitol; for, although the general movement of these products is upward, the current as a whole is repeatedly deflected, and again and again caused to impinge horizontally against the vertical tubes; and, as the currents are many times broken up and divided by their impingement upon the tubes, it seems impossible that any particle of the heated products can escape contact with the tubes, thus to impart its due quantity of heat to the surface and to the inner water currents.

3. The proper proportioning of the volume of the circulating water to the heating surface that confines it and directs its flow seems to have been carefully studied in your design. With cylindrical water tubes, unless so small as to introduce material frictional resistance to the flow, this proportion is difficult of attainment. The flow in such tubes is apt to be so slow that

bubbles of steam are generated: and, as steam takes up heat much more slowly than water, the efficiency of the surface is lessened when the action described is set up. The form of the cross-section of the water tubes in your heater, being that of an equilateral rhombus, with rounded angles, secures the attainment of any desired proportion of external heating surface to the volume of internal water current, simply by varying the angles; and the designers of your heater seem to have adopted a shape of cross-section that gives a very judicious relation of volume of current to the heating surface.

4. I cannot agree with one principle stated in your description of the boiler, as follows:

“Accordingly, the next desideratum is the largest extent of surface in proportion to size of grate and quantity of water contained in the heater.”

There may be excess of heating surface in proportion to grate as well as deficiency, and the enunciation of the principle should be remodeled to read as follows: “The next desideratum is the largest extent of *efficient* heating surface in proportion to size of grate and quantity of water contained in the heater.” From the accuracy in statements of other principles contained in your description, I think the omission of the word “efficient” was an oversight. With this modification I should hold the proposition to be sound. What is wanted is *efficient* heating surface, and enough of it in proportion to grate. I think the Capitol meets all requirements in this particular; and the extent as well as the efficiency of the surface, as arranged with reference to the currents of heated gaseous products, as well as the large part of the surface exposed to direct radiation from the incandescent fuel on the grate, must render the heater not only rapid and powerful in action, but also very economical of fuel in use, because extracting all the heat from the

gases, compatible with maintaining a proper draft, before the gases enter the uptake.

5. The principle that the grate in a sectional heater should increase proportionally to the number of sections, when the proper proportion to the heating surface has once been established, is correct for all hot water heaters, and can hardly be carried out by any heater with horizontally made up sections. Hence your use of vertical sections is in strict accordance with the best practice in the construction of hot water heaters, and secures the advantage of proportional enlargement of heating surface and grate for different capacities of heaters.

6. The construction of each leaf of the heater in two separate parts, connected at top and bottom to adjacent sections, is a feature which strongly commends itself to good mechanical judgment. In the first place, it renders the parts to be handled much lighter than where each leaf is cast integrally in a single section, and therefore diminishes the liability to breakage in shipment, while it also aids in securing good, sound castings. At the same time your method of connecting these parts is entirely simple and mechanical, employing metal joints only, and avoiding all packings or cements which are liable to give trouble in erecting heaters and to give out during use, causing annoying leaks. I cannot see how any mechanic, even of moderate skill, should experience any difficulty in making tight all the joints in the Capitol. Further, the accessibility of these joints, all of which may be easily reached without disturbing or disconnecting other parts of the heater, is a highly commendable feature, enabling any part, which through accident or long use has become imperfect, to be disconnected, without crippling the heater. Thus, should any section give out in midwinter, it may be disconnected, the boiler yet remaining in good working condition, until

warm weather, when repairs can be made without discommoding any one by stopping the use of the apparatus at a time when heat is still needed. This I consider a most important desideratum either in a hot water heater, or in a sectional steam boiler used for heating purposes. & 7. Cleaning of the heating surface, without which the efficiency of any heater or boiler is soon greatly diminished, is performed in this heater with the greatest facility, every part of such surface being reached with ease by a cleaning brush, the surface not presenting re-entrant angles, or recessed parts in which soot and ashes collect, and from which their removal is difficult.

8. As to the relative merits of wrought and cast iron for hot water heaters and low pressure steam heating boilers, there is quite a divergence of opinion among manufacturers; this opinion, for the most part, being influenced by purely commercial reasons. The facts are that cast iron resists rust (which is what ultimately uses up heating boilers, rather than service) better than wrought iron, and its power of absorbing radiant heat directly from incandescent fuel, is greater than that of wrought iron. Once in place, and properly cared for, its durability in a boiler or heater is unquestionably superior to that of wrought iron. The main objection to it is one that appeals to the manufacturer rather than the user, the greater liability to breakage during transportation when carelessly handled. For this reason, and also because good sound castings of uniform thickness in large and complicated sections, have been found, in my experience, subject to frequent exceptions, I have been wont to favor wrought iron. This leaning would be reversed in the case of a cast iron sectional heater like the Capitol, wherein the castings are not of such undue size as to render them difficult to make of uniform thickness, and devoid of defects, such as are too frequently

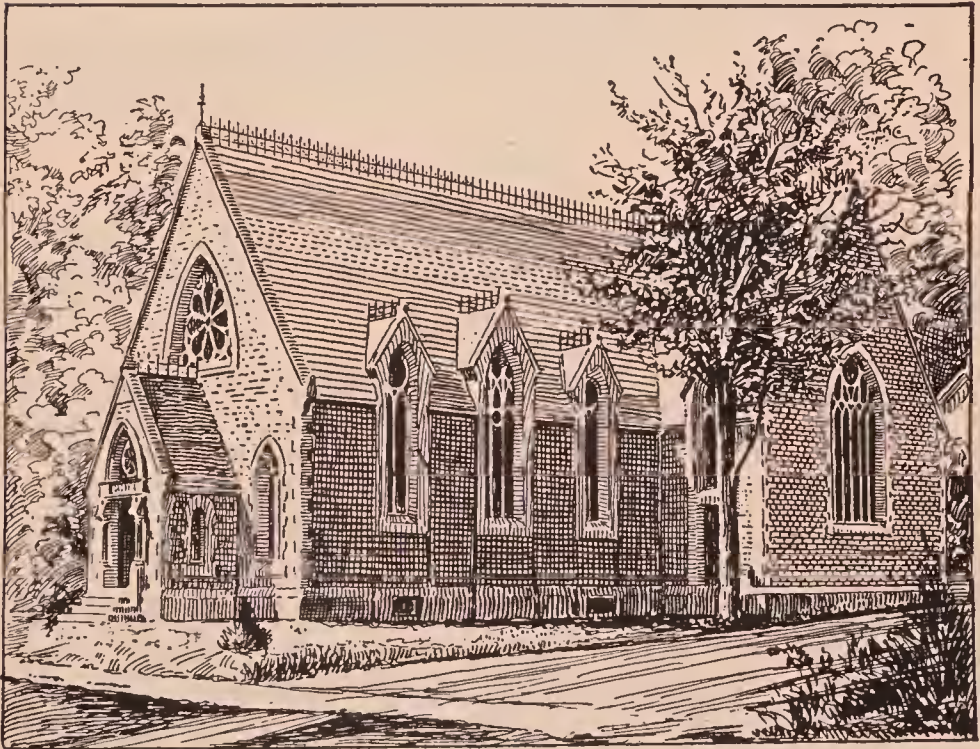
met with in some heaters of different design. Once erected on a good foundation, a heater of this material and design will endure longer and do better work than though the sections were made of wrought iron, and of the same thickness.

In conclusion, gentlemen, I give it as my opinion, based upon much experience in designing, testing and erecting heating apparatus, that you have in your new Capitol Hot Water Heater a design that will enable you to compete successfully with any hot water heater in the market, and which will give much satisfaction to your customers.

Very respectfully yours,

LEICESTER ALLEN.

April 19, 1893.



HUBBARD LIBRARY, HALLOWELL, ME.

What they say.

NEW DULUTH, MINN., March 6th, 1894.

9 This is the second winter I have used the Capitol Heater. It gives perfect satisfaction in every respect. It has kept our house warm as summer, and at times when the thermometer registered **45 degrees below** zero.

Respectfully,

H. C. BEARDSLEY,
The Hurd Refrigerator Co.

DULUTH, MINN., March 5th, 1894.

I have one of your Capitol Heaters and am very well satisfied with its working. It has done the work of heating ten rooms in the most severe weather and consumed **less coal than** I used last winter in heating four rooms with **a common base burning stove**. I am very glad I concluded to put in this heater, and am,

Very respectfully yours,

A. E. McMANUS,
Palladio Building.

OMAHA, NEB., March 6th, 1894.

The heater has given entire satisfaction, and we think is very economical. It works **first-class in all respects**, and we can cheerfully recommend it.

Yours truly,

VOEGELE & DINNING,
1110 Howard St.

MICHIGAN CITY, IND., Jan. 25th, 1894.

I take pleasure in stating that the Capitol is giving me good satisfaction. I have had no trouble with it whatever, and the **comfort and convenience of it are beyond compare**. I think it is one of the best investments I ever made. Although the weather for the last few days has been unusually cold, I have had no difficulty in keeping my house comfortable.

Very truly yours,

JARED H. ORR,
Attorney.

DULUTH, MINN., March 7th, 1894,

Your Capitol Heater is giving the best of satisfaction. Don't see how there could be any improvement, as it does the work thoroughly and **is a coal saver.**

Respectfully yours,

H. FEE.

TOLEDO. O., March 16th, 1894.

The Capitol Heater which you placed in my building last fall has proven very satisfactory in saving of fuel, ease of management and satisfactory results.

It requires **no more attention than a stove**, and the heat is very pleasant.

I am so well pleased with your heater, system of piping, radiators, etc., that I should prefer it to any heating apparatus with which I am acquainted.

Yours truly,

LINCOLN HAYS.

DETROIT, MICH., Jan. 25th, 1893.

I have found the Capitol Heater very satisfactory the past winter. During the extreme cold weather I experienced no difficulty in keeping the house comfortable. I would also state that **I found the consumption of fuel small.** Yours truly,

SIDNEY B. WIGHT,
Sec'y to the President M. C. R. R.

17 North Center Street, }
POTTSVILLE, PA., Jan. 16, 1893. }

Your inquiry of December 30, 1892, received. Up to that time the thermometer had only gone to 5° above zero, and before answering I wanted to try your Capitol a little further. Now, since that time it has gone to 7° below zero, and my previous good opinion of it has been very much strengthened. The thermometer outside is now 2° above, inside 70° above zero, a fall during the night of 2° with no draft on—in fact all drafts closed. It is compact and is business all the way through; so simple in its construction that any one who wants to can take care of it, and its heating is entirely under control. It is by far the prettiest I have ever had the pleasure of looking at, raises heat quickly, and I really **cannot recommend it too highly.** I am more than pleased with it.

Very respectfully,

DR. WM. H. ROBINSON.

BUFFALO, N. Y., Feb. 15th, 1894.

The No. 13 Capitol Hot Water Heater in my residence, No. 653 Main St., has proven entirely satisfactory. My house is exposed on all sides, and yet it has at all times been heated to a comfortable degree in all parts. Most of the winter we have **only required to fire one** of the two fire pots.

Yours truly,

R. V. PIERCE,
World's Dispensary.

CINCINNATI, O., Jan. 18th, 1893.

I have been using the Capitol Heater with entire satisfaction. It has kept the temperature at 70° at all times during the past winter, when the temperature has at times been as low as 16° below zero. **I recommend it to all who appreciate the comforts of home,**

Yours respectfully,

GEO. E. CLYDE,
Cincinnati Panel Co.

ST. PAUL, MINN., Jan. 28, 1893.

I have been using your Capitol Heater in my residence this winter, and it gives entire satisfaction. The temperature has been ranging from **15° to 24° below zero,** and I have had no difficulty in keeping the house perfectly comfortable. The temperature of every room in the house has ranged from 73° to 80°, and can with ease obtain a temperature of 80° in the rooms at any time, if desired.

Yours truly,

J. F. FRANZEN,
Assignee St. Paul German Assurance Company.

ROCHESTER, N. Y., Feb. 28th. 1894.

The Capitol gives perfect satisfaction and is just what it is recommended to be.

Yours respectfully,

JOHN P. STALLMAN,
535 Plymouth Ave

BURLINGTON, VT, March 23d, 1894.

I can't say too much in praise of the hot water heater. I have a large house and it has been **like summer all over** it through the winter.

Respectfully,

MRS. C. E. BARNES.

MARTINSVILLE, ILL., Feb. 26th, 1894.

Replying to your letter of the 23d would say, this is the second winter for our Capitol Heater. We have every reason to be glad we put it in. It warms our house effectually, up stairs and down, giving comparatively no trouble, no dirt, no anxiety. Our house is good size. Fronts west and north, so we are exposed as much as houses generally in small towns,

We warm seven good-sized living rooms and two roomy halls comfortably in coldest weather, say ten degrees below zero. In fact, **plants bloom all winter** in any room that we pretend to warm, and I think this is sufficient to satisfy the most skeptical. We use perhaps double the amount of hard coal required for a single base burning hard coal stove, and use no other heat except the one Capitol.

Respectfully,

C. K. DOUGLASS.

CHICAGO, ILL., Jan. 30th, 1894.

I am glad to say that we are well pleased with the Capitol Heater, which we have used now for nearly two winters. I think hot water **the ideal system**, and know of no better heater than the Capitol.

Sincerely,

W. H. MERRITT,
Business Mgr. The Baptist Union.

CHICAGO, ILL., March 2d, 1894.

My house stands where it is swept by the **strong west winds** which blow over this country, and is probably more exposed than the majority of houses. I have had no difficulty whatever in keeping the temperature all over the house at 70 degrees during the very coldest weather, and we have had several mornings when the temperature was from **fifteen to twenty-five degrees below zero**. The amount of coal which I have used to this date is about ten tons, and I think two tons more will last me through the season. I believe this amount can be cut down twenty per cent. by wrapping the pipes in the cellar, which I shall probably do another year.

I find the heater an extremely easy one to run, requiring very little attention; easy to dump, easy to rake off the cinders, and in all other respects, so far as my short acquaintance goes, it is perfectly satisfactory.

Yours very truly,

C. E. RAYMOND,
Chicago Manager J. Walter Thompson

BUTLER, PA., Feb. 23d, 1894.

In reply to yours of the 23d inst.: I have had the Capitol Heater in my dwelling for nearly two winters; it has worked to my entire satisfaction; has **not been one cent** of expense for repairs. My gas bills have been very materially reduced, and what is better than all is this, I have had a comfortable house. I would not have a home without the hot water system. There is no heat like it, and I do not see how any heater could work better than the Capitol.

Respectfully yours,

S. D. BELL, M. D.

PLYMOUTH, MICH., March 4th, 1894.

I am well pleased with the Capitol Heater. It is very easy to run, only requiring attention morning and night in the coldest of weather, and I consider the hot water system **far superior** to either steam or furnace, both in economy and character of the heat.

Truly yours,

LEONARD F. HATCH, M. D.

RALEIGH, N. C., March 29th, 1894.

My house is heated now by a No. 3 Capitol Hot Water Heater. The house is greatly exposed on all sides, having many large windows and good size rooms with high ceiling. The heater is placed in the open cold cellar with uncovered pipes, but very nicely warms the rooms and two large halls above. The heat is mild and summer like, and is very pleasant and agreeable in every part of the house, even in two of the bed-rooms with no radiators. My house has **never been warmed before** in cold weather, and it is wonderful how well the Capitol heats the house throughout when but little fuel is used. The circulation is rapid and the heater powerful. I am very well pleased with the heater in every way. I cannot imagine how a hot water heater can be made to beat this. It is beautiful in appearance, occupies a space in the cellar of 25 x 30 inches on the floor, and requires about the same attention and labor as a large stove.

By next winter I shall have all pipes in cellar well wrapped and heater protected from the cold air, with a liberal show of stove coal on hand; then you may send on the blizzards even worse than last January, which was fearful enough here, the thermometer at times down to zero, and I shall be all fixed up, not forgetting my little heater under the house.

Very respectfully,

J. B. HILL.

NEW KNOXVILLE, O., Feb. 20th, 1894.

The Capitol has been in use nearly two years, and is giving the best of satisfaction. No repairs or expenses have been necessary so far. I use soft coal for fuel at present. The heater is **so easily cleaned that this fuel does almost as well as hard coal.**

Respectfully,

JAMES SLACK.

SUPERIOR, WIS., Jan. 27, 1893.

Some four months since I purchased one of your No. 6 Heaters, and most emphatically say that I am more than pleased with it in every respect. In fact, **too much cannot be said** in its favor as a perfect Heater, and at the same time a fuel saver. I shall take pleasure in recommending it to my friends whenever I have an opportunity to do so. Yours very truly,

C. S. STARKWEATHER,
Rector Church of the Redeemer.

DU BOIS, PA., March 1st, 1894.

I am highly pleased with the Capitol. My fuel bill is lighter than others who use other heaters.

Respectfully,

P. S. WEBER.

ASHLAND, WIS., Jan. 23, 1893.

We have had your Capital Heater, No. 13, in operation for about two months in the residence of Mr. E. A. Shores, and the thermometer has registered as low as **30° below zero.** We had **warm rooms and even temperature** throughout the house. The heater is perfectly satisfactory

JOHN W. FOSTER.

959 Jefferson Ave., DETROIT.

I have used the Capitol Heater for two years, and find it gives perfect satisfaction. It is a quick and powerful heater and easily managed by anyone. There is nothing about it to get out of order and it apparently **will last indefinitely** without repairs. I have been using the hot water system for six years, and know of no better heater than the Capitol.

CHAS. DOUGLAS, M. D.



Residence of DR. H. H. DARST,
Toledo, O.



Residence of R. W. SMITH,
Toledo, O.

A Word to the Trade.

YOU have two motives in handling heaters. The first is money and the second is reputation, which in the end means more money. If you are a far-seeing business man, we need not tell you that the best way to make money is not to squeeze the last dollar out of the contract you have on hand to-day, because if you should do that, even though it might give your customer a certain degree of satisfaction, it would not make him an enthusiastic advocate of your goods and your work.

Take the question of heaters—hot water or steam heaters. You can buy heaters for a great deal less money than you can buy a Capitol or Hecla; you can buy almost any heater on the market a little cheaper. There are no higher priced goods than ours offered for sale, but you know that is the kind of goods you want to handle. You want to give your customers quality, which means efficiency and durability. The quality of our heaters is plain to see when you look at them. Such goods as ours cannot be made without a great deal of expense and care in designing the heaters themselves and the equipment for their manufacture. We have the most elaborate and expensive patterns and equipment in the heating business of this country. We have put more time and thought and more high-class skilled labor on that part of our investment than anyone else has thought necessary, but the result shows in the heater. You can see it and your customers can see it. Compare the Capitol with any other heater you ever saw, and what do you think of it? You know the

old story that every block of marble contains a beautiful statue, and to bring it out it is only necessary to cut away all the marble that does not belong to it. If you look at one of our sections you will see that we have taken away every shaving of metal that is not necessary to give the very highest efficiency. Every line of our castings shows strength combined with lightness, and a graceful but thoroughly business-like appearance that tells better than words can do what efficiency they embody.

At the same time, when you are going to buy a heater it does not cost you materially more to get the best—that is, the Capitol or Hecla. We try to approximate pretty closely the prices of other heaters that may be regarded as first-class, so you cannot be very much out of pocket even on the first cost of your first job if you use our heaters. In the long run you are away ahead.

When we first put our heaters on the market we do not think we had a single competitor that did not over-rate his heaters. We under-rated ours so much that people laughed at us and said we were giving away good iron. We knew that, but we had seen the results of starting the other way. So we started with our boilers materially under-rated and spent two years finding out just what they were capable of doing. Then we raised our rating a little, and the chances are that we may raise it a little more, because we are sure they will do more work—we do not know how much more—than our present rating.

That gives those of our dealers who have handled our goods a feeling of confidence in them and in what they will do that is very different from the feeling with which they regard other boilers. Generally, the only question is how much allowance to make for over-rating. With our boilers the published rating “goes.”

The question of price comes in here again very hard. If in one case you have to pay \$200 for a thousand-foot boiler and you can buy another thousand-foot boiler for \$175 it looks on the face of it as if the latter would be the economical thing to buy; but if you have got to take off 25 per cent. from the rating of the \$175 boiler, then you are only getting \$150 worth of boiler and paying \$175 for it. There is not much economy in this.

In designing our heaters the principal point of view from which we looked at it was the fitter's. Right here it is perhaps in order to say that we were the first company, manufacturing heaters in a large way, to start from the first on the basis of selling our goods through the trade only. Other manufacturers claim to have fallen into line more or less, but so far as our knowledge goes there is not to-day, and never has been, another company that takes no contracts under any circumstances and is in no way, directly or indirectly, connected with or interested in any contracting firm.

Such a business policy as this must necessitate special attention to the requirements of the fitter. We therefore planned to make a heater that should be easier than any other to handle and set up and, if a repair should ever become necessary, easier to repair. We are told, and believe, that we have succeeded in this. Our ash-pit is the biggest and heaviest thing about our heater and it is no trouble at all to carry that into any cellar through an ordinary door. It is not necessary to pull the house down, nor to set up the heater first and build the house around it; nor is a derrick needed to get the heater into place. After the ash-pit is set, one man can carry the sections in. 6

The Capitol has been set up in repeated instances by men who had never seen one before, and they are all delighted with the way it goes

together. If a man of average intelligence, even if he is not a mechanic, will follow the instructions that we send out he cannot fail to put the heater up very quickly, with no trouble at all, and all the joints and everything about it will be perfect from the start.

All this, it should be remembered, is a distinct saving of money, and should be considered in figuring the cost of the heater.

There are heaters that have some pretty good points that are very hard to discover unless a man is an expert of the highest grade and gives a great deal of study to the construction in question. That is not true of the Capitol. We have so devised it that its strong points stick out in such a way that anyone can see them.

We started this business in a pretty small way and our first work was principally right around home; and for quite a long time—until our business got beyond our personal observation—we were able to say truthfully that no one who wanted a heater and saw the Capitol ever bought anything else. Our trade generally find this to be pretty nearly the rule in their experience. If an intelligent business or professional man looks at two or three heaters and then sees the Capitol, he has no doubt that that is the heater he wants and our dealer gets the order unless his competitor has some special pull or spends a great many dollars' worth of time in talking the customer into his way of thinking. All this valuable time and expenditure of salesmanship are dollars saved to our dealers, because it has become a proverb in the trade that "the Capitol sells itself."

All that we have said about the Capitol applies with equal force to the Hecla, which is precisely the same thing, with the necessary modification of the sections to adapt it to effective steam work.

DR. J. H. CARSTENS.



WOODWARD AVE.
RESIDENCES
DETROIT.

W. H. EDGAR.

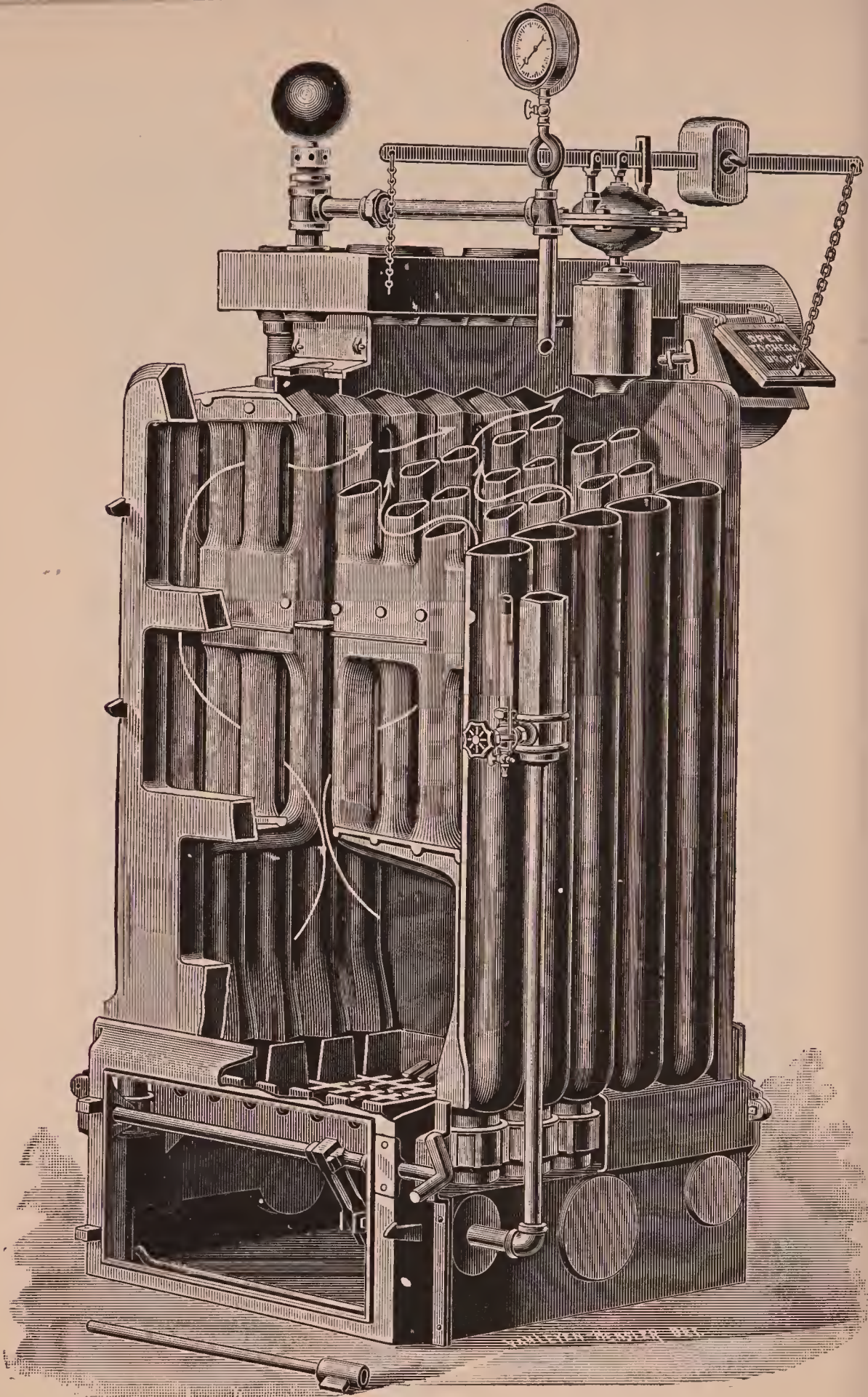


D. W. BROOKS.



GEO. L. BEECHER.





Hecla Steam Heater.



Residence of FRANK MURPHY, Omaha, Neb.
Heated by the Hecla Steam Heater.

While we do not recommend steam heat in general, there are cases where it is perhaps preferable and many others where it is chosen by the house owners for one reason or another. In order to meet this demand, we have constructed a steam heater having the general external appearance of the Capitol Hot Water Heater and possessing all its points of constructive excellence.

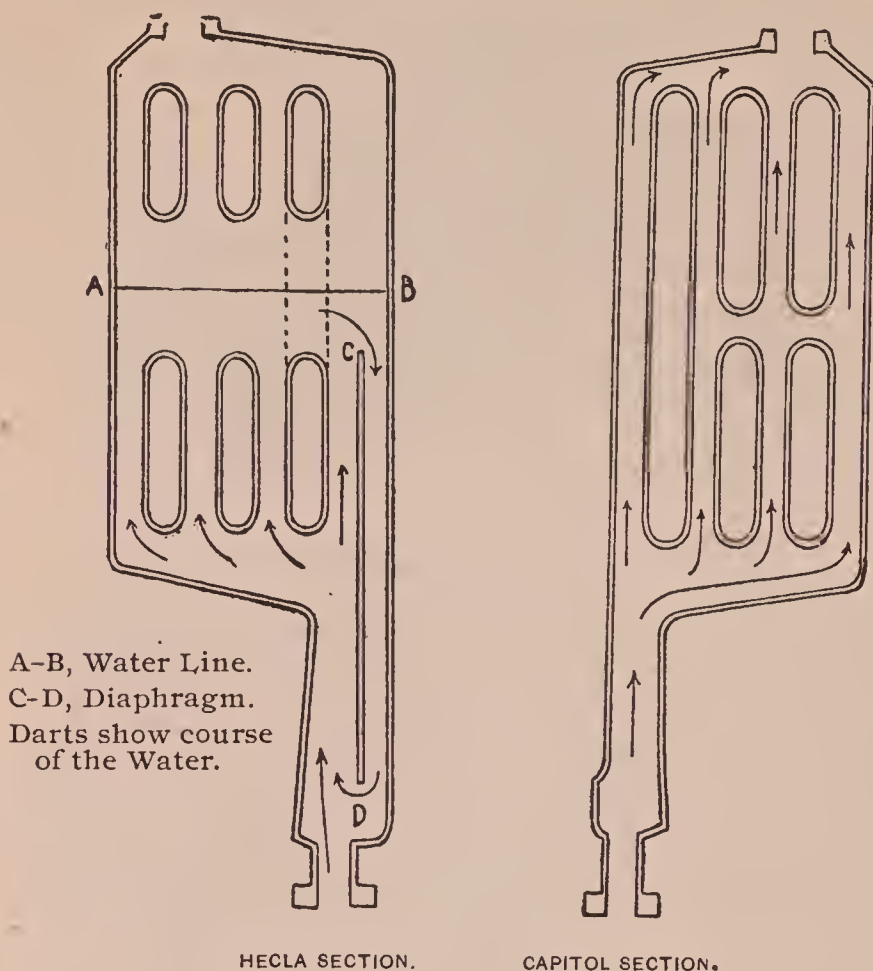
The action of a steam heater is similar to that of a hot water heater. The gases must be brought in contact with the surfaces in the same way, so that the water may absorb as much as possible of the heat.

The water must be made to circulate rapidly over the heating surfaces.

The proportion of grate to fire surface must be correct and uniform.

With steam, even more perhaps than with water, it is imperative that flat surfaces and horizontal currents be avoided.

All this has been provided for in our Hecla Steam Heater. Its base, front, back and top are the same as those of the Capitol. The interior sections differ from those of the Capitol as shown by the following cuts:



In the Capitol section the waterways are reduced to a size which would be undesirable for steam. All the water of a steam system is that contained in the boiler, that which is held by the steam, and that which has been condensed and is on its way back from the radiators to the boiler. This is a very small quantity in comparison with the volume contained in a hot water apparatus, and it can easily be made too small for uniform operation. We have provided against this by making all the waterways a little larger in the Hecla.

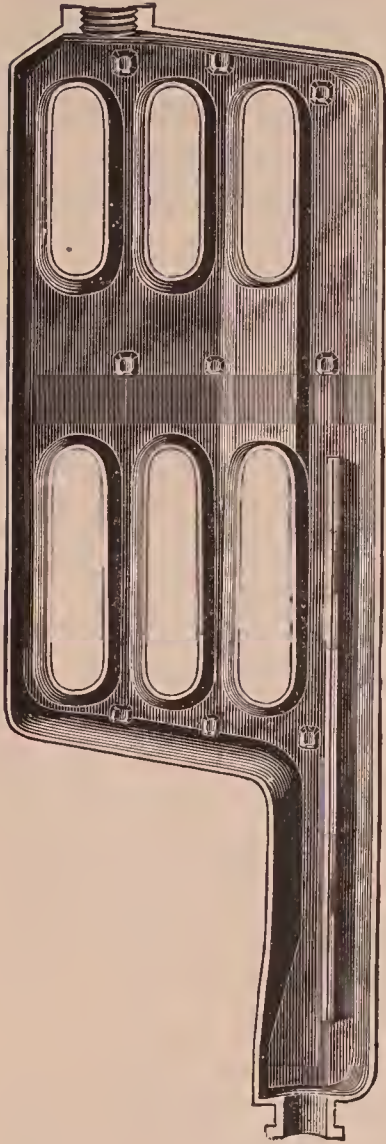
The water line in the Hecla is carried at about the middle of the heater. The middle waterway of the Capitol has not sufficient vertical depth to permit any fluctuation of the water line without bringing it into the vertical tubes, which would cause surging and an uneven action. In the Hecla we have therefore increased the depth of the horizontal waterway.

In any kettle or boiler steam is formed, not at the surface of the water, but at the bottom where the heat is applied. As the globules of steam are formed they immediately rise to the surface. If they are obstructed, as by a flat surface above them, they lodge until a sufficient accumulation frees the mass, which then ascends in a body. This causes a surging of the water and an unevenness in the action of the boiler which is objectionable. In the Hecla there are no flat surfaces above the water anywhere, and as steam will to some extent cling to vertical side walls of a boiler, we have sought to give the sides of our vertical waterways an inclination which enables the steam to quickly free itself, so that it can rise promptly to the surface of the water and pass into the steam chamber which comprises the upper half of the heater.

We have previously explained the circulation in the hot water heating system. While there is a certain similarity in the operation of the steam heating system, there is also a material difference. The water that has been condensed in the radiators comes in at the bottom of the boiler, and in the form of steam leaves it again at the top on its way to the radiators.

In addition to this general movement of the water *through* the heater, corresponding to the circulation in a hot water system, there is in a steam boiler an independent circulation of the water *within* the heater. As the globules of steam arise they carry up with them to the surface of the water some particles of cool water.

As the steam is liberated this comparatively cool



INTERIOR OF A HECLA SECTION.

water is left at the surface. By the force of gravity it immediately seeks to descend again to the bottom of the boiler. In many boilers these particles of cool water have to force their way downward against the ascending current of steam. This causes eddies and counter-currents, which produce an uneven action of the boiler.

In the Hecla this is provided against by increasing the outermost waterway and dividing it by a diaphragm which extends from a point close to the bottom connection where the water enters the section, up to a point just below the water line. In this extra waterway outside of the diaphragm there is a constant downward current caused by the particles of cool water above described, which are carried along the surface to the outer and cooler waterway, where they return to the bottom of the heater without interfering with the uniform upward movement in all the other vertical water tubes. This keeps the water moving constantly and rapidly over the heating surfaces, which promotes the efficiency of the boiler.

The steam chamber of the Hecla is made up of the upper halves of the sections, and the fact that the hot gases on their way to the smoke pipe pass among the pipes, insures thoroughly

dry steam, so that water is not carried from the boiler into the pipes and radiators.

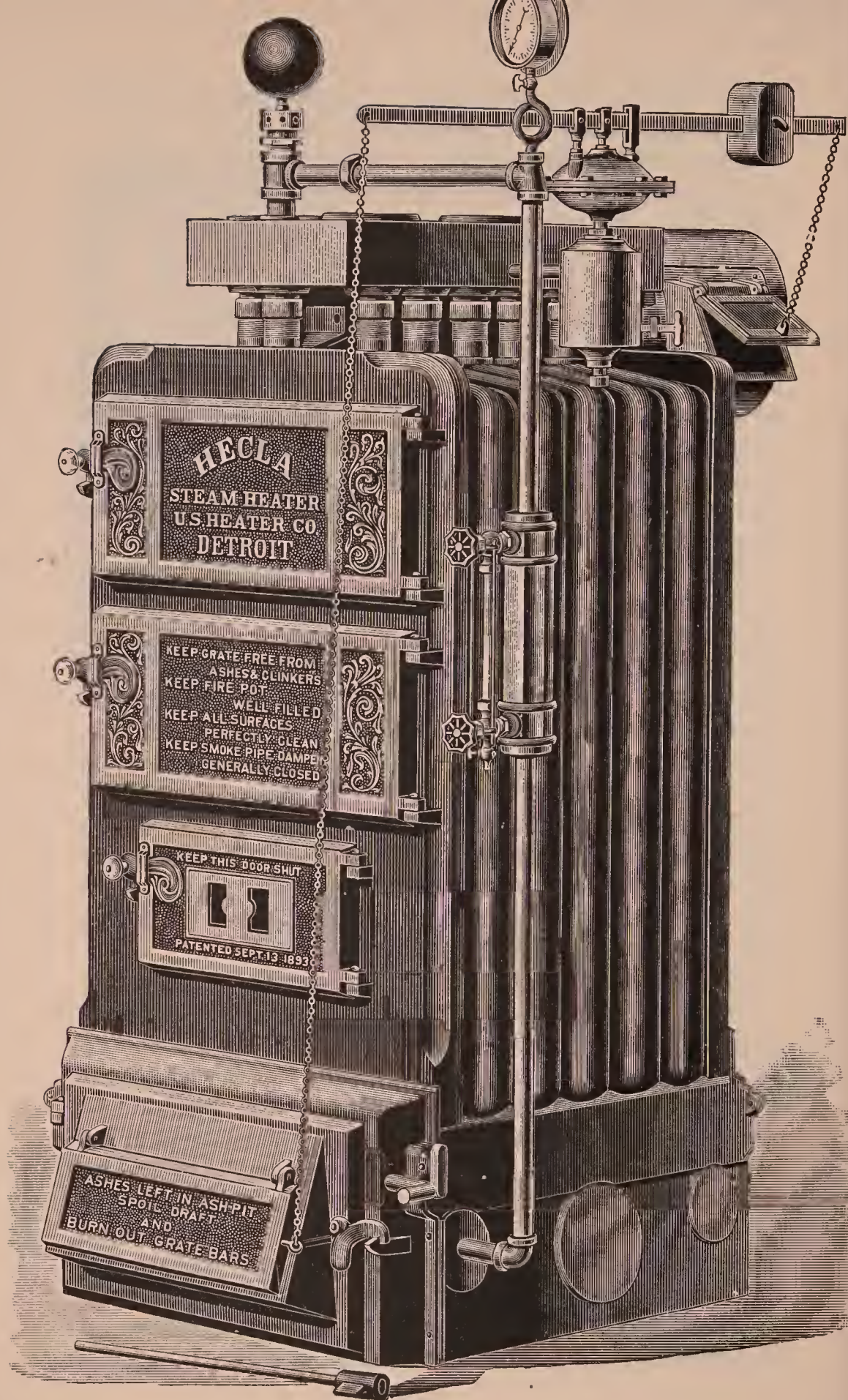
In no other house-heating boiler can steam be so quickly raised and retained so long with the same consumption of fuel. No other maintains a water line of equal steadiness.

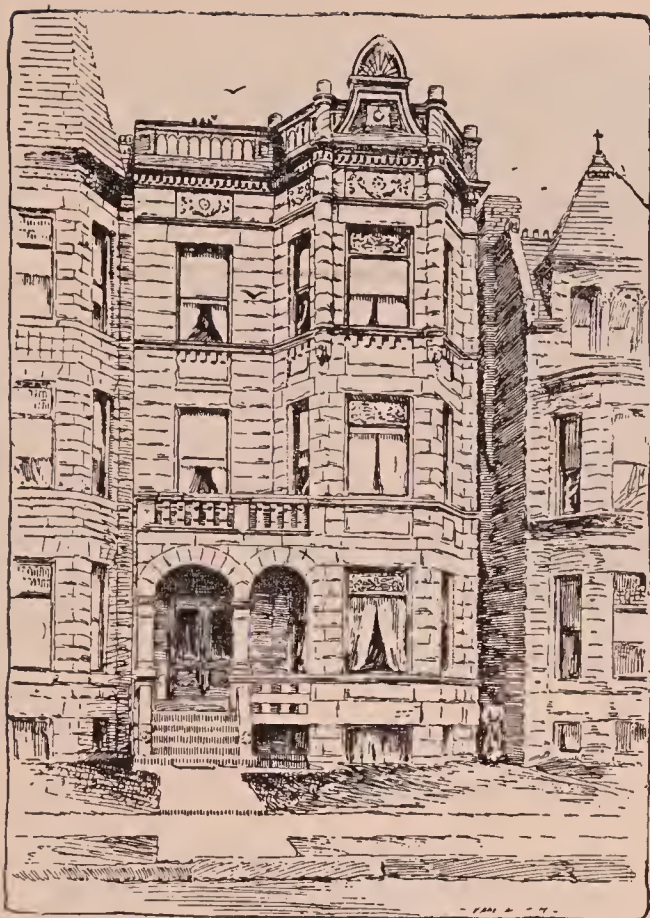
The Hecla is constructed on the safety-sectional plan, which prevents the possibility of any serious trouble in case an explosion should occur. If the safety valve should get out of order, or if any other accident should happen to the rest of the apparatus, so as to cause the boiler to burst, it would be merely a cracking of one section, which would be too small to cause even serious annoyance.

The Hecla, like the Capitol, is easily handled and set up; easier to clean than any other heater possessing anything like the same economical arrangement of fire surface; can be repaired by replacing a single broken section without disturbing the rest of the boiler; a broken section can be cut off and the rest of the boiler used without it until it is convenient to put in a new section; its joints are all metal, easily made tight, and if necessary tightened when the boiler is in use without even opening a fire door; and its proportion of grate to fire surface is always the same and always just right.

So much for the theoretical perfection of the Hecla. We did not, however, put it on the market without giving it a thorough test, and we have had it in use in different parts of the country during the past winter, which was exceptional in its violent changes of weather. Wherever used it has given the highest satisfaction, showing first-class efficiency and extraordinary economy.

The Hecla is carefully made of the best materials and thoroughly tested and inspected before shipment. We absolutely guarantee it in respect to its capacity and to the perfection of its material and workmanship.





Flat building of FRANK DEPPE, 1163 N. Clark St., Chicago, Ill.
Heated by the Hecla Steam Heater.

1163 N. CLARK ST., CHICAGO, ILL., April 14, 1894.
GENTLEMEN:

I have been using the Hecla Heater placed in my three story Flat Building last fall with entire satisfaction. It has *never failed* to keep the temperature to 70 degrees, and above, the past winter.

I am more than pleased with the Hecla, and take pleasure in recommending it to all that are interested in House Heating and the Comfort of a Home.

Respectfully,

FRANK DEPPE.

POTTSVILLE, PA., April 16, 1894.

GENTLEMEN:

The Hecla Heater takes up less than one-half the room my old heater took. I did not think it would make steam enough to heat the house. I used five wheel-barrows of the best stove coal in the old heater. The little Hecla does it with two and keeps the steam better than the old coal-eater ever did.

I am pleased with your Hecla Heater.

JOHN J. TOOLE.

CHICAGO, ILL., Jan. 12, 1894.



Residence of W. H. PETTEE,
Chicago, Ill.

Heated by the Hecla Steam Heater.

The Hecla Steam Heater has given good satisfaction; kept the house throughout at *summer temperature, even in the coldest weather*, with less than two pounds pressure upon the steam gauge. Ordinarily scarcely any pressure required. Simple in idea, efficient and noiseless in action, easily looked after and cleaned, with a grate that is plaguey near perfect in that line, seems almost *the Ideal Heater* itself for houses.

Respectfully,
W. H. PETTEE.

JACKSON, MICH., Jan. 24, 1894.

DEAR SIRs:

I am very much pleased with the Hecla Heater, and I think it will do all that is claimed for it.

Yours truly,
W. H. HAMILTON.

CHICAGO, January 15, 1894.

DEAR SIR:

In answer to the question whether I am satisfied with the Hecla Steam Heater, I will say that I am pleased with the same since I have covered all the pipes with asbestos and adopted the following rules.

1st. Set the ball on the lever so that it closes ash pit door at one pound pressure, and so that it opens the check valve or door $\frac{5}{8}$ or $\frac{3}{4}$ inches.

2d. Then clean the fire pot well of ashes and cinders and fill the pot with coal to the bottom of the fire pot door.

3d. At about 10 o'clock at night detach the chain from the ash pit door and cover the well filled fire pot with coal siftings, shut the damper in the smoke pipe and the fire will keep until 7 or 8 o'clock in the morning.

Respectfully yours,
JACOB SCHNABLE.



Elmwood Avenue Police Station, Detroit, Mich.
Heated by Hecla Steam Heater.

DETROIT, Mar. 8, 1894.

The Hecla Steam Heater in the Elmwood Avenue Station is giving the best of satisfaction and we are well pleased with the results obtained.

Yours very truly,

METROPOLITAN POLICE COMMISSION,

J. G. HOFFMAN,

Secretary.

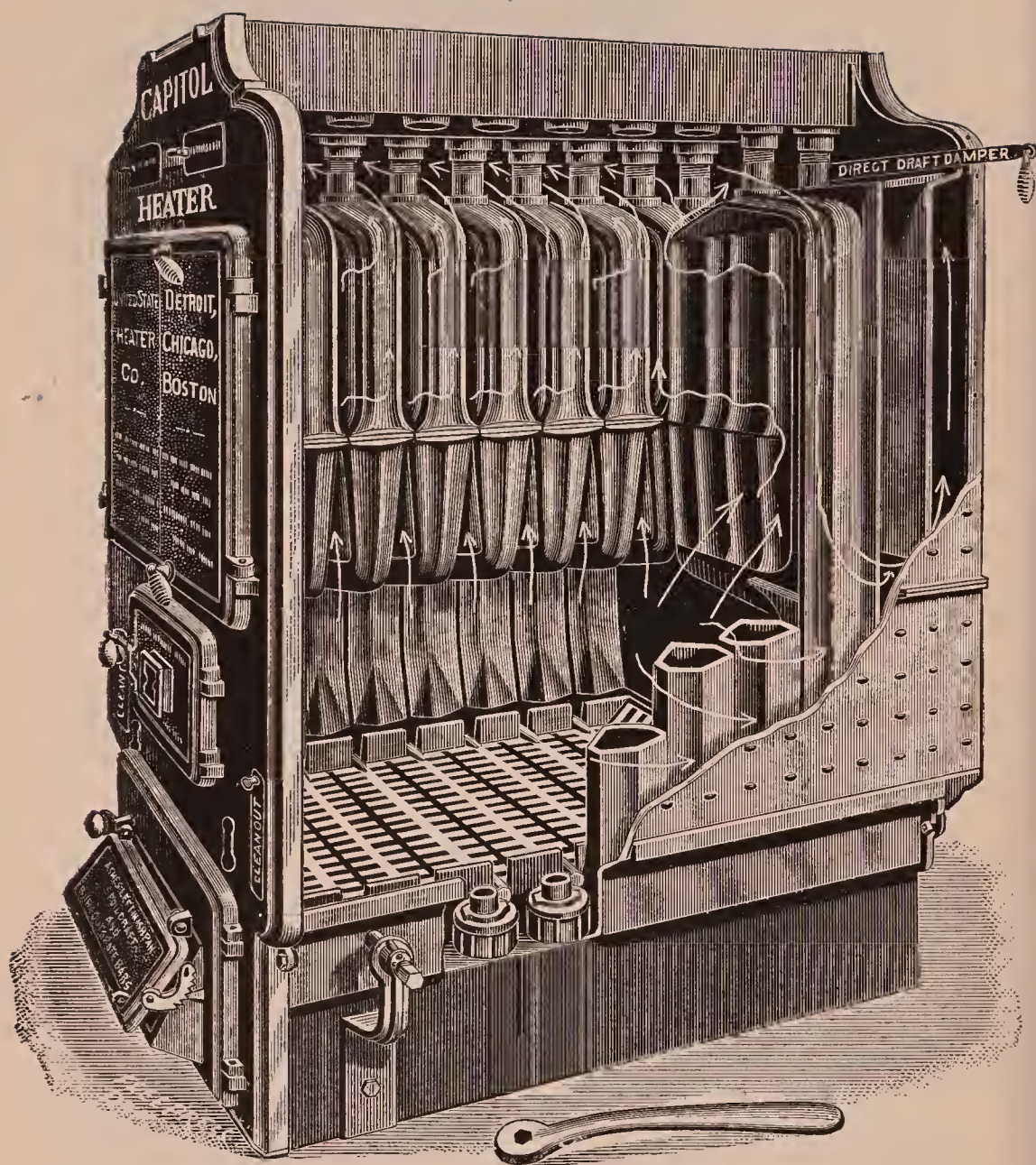
DETROIT, January 20, 1894.

GENTLEMEN—I had one of your No. 3½ Hecla Steam Heaters put in my 13-room house and must say that it is the best, cheapest and quickest I ever knew of in the way of heating apparatus.

I can get steam in 15 minutes and 1½ tons coal will supply it for a month. I can highly recommend the Hecla Steam Heater from my experience in using it.

Respectfully,

CHARLES WERNER.



THE "FOUR HUNDRED"
CAPITOL HOT WATER HEATER.

The "Four Hundred" Capitol and Hecla.

The 400 Capitol and Hecla heaters are made in extra large sizes for heavy duty. They cover the same general principles of construction embraced in the smaller heaters. The intermediate section shows a slight modification which leaves openings between the sections immediately over the fire-pot instead of having them fit snugly against each other. This simply reduces the fire travel and the flue surface and converts the entire lower half of the section into direct surface exposed to the rays of heat from the fire. The flue surface and fire travel are again increased, however, by putting on a paneled cast iron outer casing, which makes a return flue. The gases pass downward from under the top header over the sides of the heater and then to a smoke opening at the rear.

The back is a water section, but the front is a heavy plate casting, well lined where most exposed to the fire.

The operation of these heaters is exactly the same as in the older construction. We have the vertical circulation, lateral draft, extensive fire surface and the same grate and ash-pit arrangement.

The 400 series of heaters, both Capitol and Hecla, are in successful use in many large residences and public buildings all over the country.



The Mascot Hot Water Heater.

THIS Heater is specially adapted for small heating plants, such as are demanded in small houses, flats, green houses, etc., and there is an ever-growing requirement for small heaters for furnishing hot water supply in the kitchens and laundries of hotels, hospitals and other institutions, and also for barber shops, baths, etc.

The body of the Mascot is a single thimble-shaped casting, the top and sides of which are hollow, forming an unbroken waterway. This casting stands upon an ash pit and is connected at the top with a round, nearly flat, water section. The only openings in the body of the heater are the one opposite the fire-door, one for the return pipe at the back of the heater, and the 4-inch opening at the top where it is connected with the upper section or dome. Below the dome is a smoke space, enclosed by iron plates. In the front plate is the fire-door and at the sides are clean-out doors. The smoke-pipe collar is at the back. The corrugated walls of the fire-pot present a great extent of surface to the direct action of the radiant heat, while the draft after striking the crown is deflected through the opening and passes up against and under the top dome and out through the smoke pipe.

The ash-pit and grate are round, and where it is desired to set the heater on a floor it can be provided with cast iron bottom-plate and stove legs.

The heater is as simple as possible in every respect. It is easily handled, easily set up and easily cleaned. In setting it up there is only one joint to be made, and that is the right-hand nipple connecting the heater proper with the top dome.

The circulation of the water in this heater is uniformly vertical, with no lateral water courses and no flat sections.

The heater is shipped in parts and can easily be carried into any cellar.

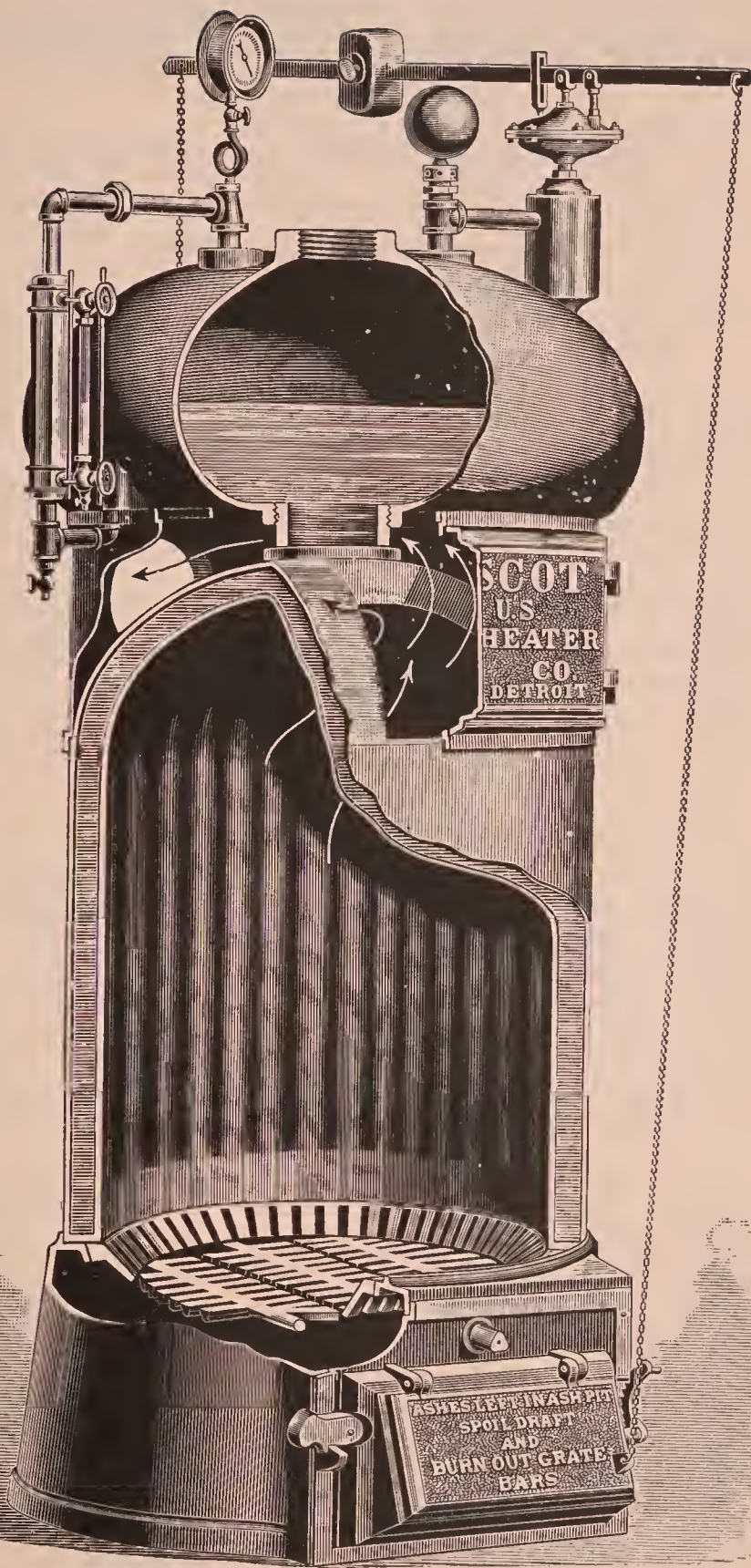
The grate has the perfect arrangement for shaking and dumping which has proved so successful and satisfactory in the Capitol and Hecla. The area of the grate is changed in each size, making the proportion of grate to fire surface uniform.

Clinker doors provide means for keeping the grate properly cleaned, without trouble.

This construction gives a very high degree of efficiency, combined with perfect combustion of fuel, and the Mascot is gotten up in handsome style, perfect in workmanship and material.

THE MASCOT STEAM HEATER.

IS the same as the Mascot for hot water, excepting that in place of the shallow water section at the top a deep steam dome is used. In the accompanying cuts, the broken-out view is that of the steam heater, showing the water line and the steam chamber. The cut of the complete heater represents the Mascot for hot water.



CAPACITY AND DIMENSIONS

CAPITOL ^{HOT} WATER HEATER

RATINGS ARE WITH UNCOVERED MAINS.

SINGLE FIRE-POT SIZES.

No.	Square Feet of Radiation Heater will carry in Building besides Mains.	Height in inches.	Width in inches.	Depth in inches.	Regular Flow Connections. (returns duplicate.)	Diam. of Smoke Pipe. Inches.	Size of Grate.	Shipping Weight, Pounds.
301	400	63	28	22	2-2 in.	8	17X17	1700
302	510	63	28	26	2-2½	8	17X21	2000
303	635	63	28	30	2-2 in.	9	17X25	2250
304	765	63	28	34	2-3 in.	9	17X29	2500
305	875	63	33	30	2-2 in.	10	22X25	2400
306	1050	63	33	34	2-2 in.	10	22X29	2600
307	1250	63	33	38	2-2½	10	22X33	2900
308	1425	63	33	42	2-3 in.	10	22X37	3100

DOUBLE FIRE-POT SIZES.

							Each Grate	
309	1700	74	75	26	{ 3-2½	13	22X21	5100
310	2000	74	75	30		13	22X25	5800
311	2400	74	75	34	{ 3-3 in.	14	22X29	6500
312	2700	74	75	38		14	22X33	7100
313	3000	74	75	42		14	22X37	7700

The "Four Hundred" Capitol.

SINGLE FIRE-POT SIZES.

405	1600	66	40	40	{ 3-4 in.	12	26X30	3200
406	1850	66	40	45		12	26X35	3500
407	2100	66	40	50		12	26X40	3800

DOUBLE FIRE-POT SIZES.

409	3400	77	102	40	{ 6-4 in.	15	26X30	7000
410	3900	77	102	45		16	26X35	7600
411	4400	77	102	50		17	26X40	8200

This list is to be read in connection with explanation on page 75.

Explanation of Heater Price Lists.

Ratings of Capitol and Mascot hot water heaters are with uncovered mains. With mains covered heaters will carry 10 to 15% more. Ratings of Hecla heaters and Mascot steam heaters are with covered mains. When mains are not covered they should be figured as radiation.

Our ratings are for boilers pretty centrally located with mains not exceeding 15% of the radiating surface in the building. If the mains exceed this proportion, or if the boiler is located at one end or corner of the building, a larger boiler should be used. Where the draft is not first-class or the flue lacks in capacity, a larger boiler will overcome the difficulty to some extent, but the best way is to change the flue.

Our ratings are for direct radiation. When indirect is used, each foot should be counted as equal to a foot and a half of direct radiation in estimating size of boiler. For example, having a job requiring 1,000 feet of direct and 1,000 feet of indirect radiation, it would be necessary to figure the 1,000 feet of indirect as 1,500 feet and a total boiler capacity of 2,500 feet would be required.

We **absolutely guarantee** the rating of our heaters, provided the radiation in each case is ample for the requirements of the building, the work of erecting the apparatus properly done and the apparatus operated in accordance with our printed instructions. In the case of steam heaters the radiation must be sufficient to heat the building to the required temperature in the coldest weather, with not to exceed 2 lbs. indicated pressure at the boiler. This guaranty does not apply where only a portion of a building is to be heated.

Capitol Top Headers are tapped for altitude gauge and hot water thermometer.

Double Fire-Pot Capitol Heaters are furnished with cast iron twin connections, but no valves. We will furnish iron body gate valves with drilled flanges for \$35.

Double Fire-Pot Hecla Heaters are furnished with iron body angle valves for flow and return connections, but the pipe and fittings for making the connections are not furnished.

Single Fire-Pot Hecla Heaters have two steam outlets and one return inlet.

The Size of Smoke-Pipe needed is indicated in the tables. The smoke-pipe collars are 10" on all 300 heaters, 12" on all 400 heaters, and 8" on all Mascots. Double fire-pot sizes have two collars.

Capitol and Hecla Heaters can be set in brick-work if desired, but we think it hardly pays. We furnish with each heater, without extra charge, asbestos for covering it.

Where the heater is used for supplying water for domestic purposes, and is connected with a water-works system of high pressure, the direct pressure upon the heater should be relieved by connecting it with a small tank having a ball cock.

We guarantee that our heaters shall be in perfect order when delivered to the transportation company at point of shipment, and in case there is any defect of material or workmanship in any heater or part thereof furnished by us, we agree to promptly furnish a new heater or part thereof free of charge, and deliver it at the place where such defective heater or part may be, but we will not be responsible for any damage to goods in transit or from careless handling.

CAPACITY AND DIMENSIONS

HECLA STEAM HEATER

RATINGS ARE WITH COVERED MAINS.

SINGLE FIRE-POT SIZES.

No.	Square Feet of Radiation Heater will carry in Building besides Mains.	Height in inches. Without Trimmings.	Width in inches.	Depth in inches.	Height of Water Line. Inches.	Steam Outlets. Inches.	Return Inlets. Inches.	Diam. of Smoke Pipe. Inches.	Size of Grate.	Shipping Weight, Pounds.
303½	450	63	33	26	42	2½	2	9	22X21	2500
305	550	63	33	30	42	2½	2	10	22X25	2700
306	650	63	33	34	42	3	2½	10	22X29	2900
307	750	63	33	38	42	3	2½	10	22X33	3300
308	850	63	33	42	42	3	2½	10	22X37	3600

DOUBLE FIRE-POT SIZES.

									Each Grate	
310	1100	63	75	30	42	3	2½	13	22X25	6200
311	1300	63	75	34	42	3½	2½	14	22X29	6900
312	1500	63	75	38	42	4	2½	14	22X33	7700
313	1700	63	75	42	42	4	2½	14	22X37	8500

The "Four Hundred" Hecla.

SINGLE FIRE-POT SIZES.

405	1000	66	40	40	50	4	3	12	26X30	3600
406	1150	66	40	45	50	4	3	12	26X35	3900
407	1300	66	40	50	50	4	3	12	26X40	4200

DOUBLE FIRE-POT SIZES.

									Each Grate.	
409	2100	66	102	40	50	4	2½	15	26X30	7600
410	2400	66	102	45	50	4	2½	16	26X35	8200
411	2700	66	102	50	50	4	2½	17	26X40	8800

This list is to be read in connection with explanation on page 75.

CAPACITY AND DIMENSIONS
OF THE
MASCOT HOT WATER HEATER.

RATINGS ARE WITH UNCOVERED MAINS.

No.	SQUARE FEET OF RADI- ATION HEATER WILL CARRY IN BUILDING BESIDES MAINS.	OUTSIDE DIAMETER OF HEATER, INCHES.	HEIGHT OF HEATER, INCHES.	DIAMETER OF GRATE, INCHES.	SIZE OF SMOKE PIPE, INCHES.	SHIPPING WEIGHT. POUNDS.
15	275	23	47	15	8	700
18	375	26	47	18	8	800
21	475	29	50	21	8	900

MASCOT STEAM HEATER.

RATINGS ARE WITH MAINS COVERED.

No.	SQUARE FEET OF RADI- ATION HEATER WILL CARRY IN BUILDING BESIDES MAINS.	OUTSIDE DIAMETER OF HEATER, INCHES.	HEIGHT OF HEATER, WITHOUT TRIMMINGS, INCHES.	DIAMETER OF GRATE, INCHES.	SIZE OF SMOKE PIPE, INCHES.	SHIPPING WEIGHT, POUNDS.
115	175	23	53	15	8	800
118	250	26	53	18	8	900
121	350	29	56	21	8	1000

These lists are to be read in connection with explanation on page 75.

FOR SOFT COAL.

OUR regular Capitol and Hecla Heaters are designed for use with hard coal. Many of them are in successful use with soft coal, but it is where the coal is of excellent quality, the draft exceptionally good, and other conditions favorable. We are making a special heater for soft coal which we think excels anything on the market. Cuts and description of it will be sent to anyone interested. Our regular heaters we do not guarantee or recommend except for first-class hard coal.

FOR WOOD.

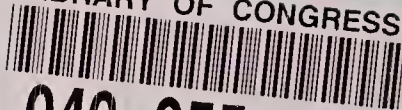
NO hot water heater ought to be used regularly with wood as a fuel. Wood smoke, when condensed on the cool heating surfaces, covers them with a creosotic coating which is difficult to remove, except as it is burned away by hot fire. Wood is often used for a small fire to take the chill off the house, and in some cases is constantly used, but doubtless at the expense of efficiency, and makes extra labor in keeping the heater properly cleaned.

MAGAZINE FEED.

WE do not make a heater with magazine feed and do not intend doing so, as the magazine displaces so much valuable heating surface as to seriously impair the efficiency of a heater. We have known of many cases where magazine-feed heaters are used as surface burners, the users having become disgusted with the magazine arrangement. For the best results the heater should have attention a certain number of times each day, when it is just as easy and a great deal better to throw on the proper amount of coal. Besides, coal in the magazine interferes with the proper cleaning of the fire.



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